DOCUMENT RESUME

ED 455 608 EA 031 206

AUTHOR	Achilles, C. M.; Finn, J. D.
TITLE	The Varieties of Small Classes and Their Outcomes.
PUB DATE	2000-11-00
NOTE	57p.; Paper presented at the combined National Invitational Conference of the U.S. Department of Education and Temple University's Laboratory for Student Success (Washington, DC, November 30-December 1, 2000). Written with the assistance of G. Pannozzo, S. B. Gerber, and K. Schwengel. University research supported by a Spencer Foundation Grant.
PUB TYPE	Reports - Evaluative (142) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Academic Achievement; *Class Size; Comparative Analysis; Educational Change; Elementary Secondary Education; Federal Programs; State Programs; Statistical Analysis; *Teacher Student Ratio
IDENTIFIERS	*Student Teacher Achievement Ratio Project TN

ABSTRACT

The federal class-size-reduction initiative and programs such as Wisconsin's Project SAGE (Student Achievement Guarantee in Education) provide funds for a variety of "small-class models," including intact small classes with one teacher, team-taught classes with 30 or more students and 2 full-time teachers, "push-in" or "pull-out" classes with 25-30 students and an additional teacher who works with small groups of students for part of the school day, and other options. The latter models change the pupil-teacher ratio (PTR), but not the actual class size (CS). This paper summarizes the research evidence regarding achievement outcomes under these different arrangements, and compares the evidence of PTR and CS generally. The paper concludes with five major recommendations. Research studies on PTR and CS are both useful, but should proceed on separate tracks since the treatments, variables, and processes in PTR and CS are not the same. A strong effort should be made to educate all relevant interested parties (such as parents, researchers, the media) on the differences between PTR and CS. The U.S. Department of Education must be an advocate for the correct implementation of CS and for the dissemination of documents and information on PTR and CS that use the terms explicitly. Evaluators and researchers should document carefully the contexts in which students are educated so that issues of PTR and CS are evident. Some "ideal" implementations of CS need to be studied and evaluated so that there begins to be a substantial body of CS research data, where the event described is actually CS, not PTR or some combination of the two. Two tables, Teaching Activities in a Small Class (K. Schwengel, 2000), and Much Research Starts from Clinical Observation (J. Prout et al), including three figures are appended. (Contains 12 references.) (Authors/PKP)

ED 455 608

THE VARIETIES OF SMALL CLASSES AND THEIR OUTCOMES *

C. M. Achilles, EdD
Professor, Education Leadership
304 Porter Ed. Building
Eastern Michigan University
Ypsilanti, MI, 48197

J. D. Finn, PhD
Professor, Graduate School of Education
Christopher Baldy Hall
SUNY, Buffalo, NY 14260

with the assistance of:

G. Pannozzo
Graduate Assistant
Christopher Baldy Hall
SUNY, Buffalo, NY 14260

S. B. Gerber, PhD
Technology Center
Christopher Baldy Hall
SUNY, Buffalo, NY 14260

K. Schwengel, Teacher
Hillcrest Elementary School
Burke County Schools
Morganton, NC 28655

11/30-12/1 2000
Rev. 12/13/00

Please do not cite or quote without permission. Prepared for the conference: "Taking Small Classes One Step Further" sponsored by The Laboratory for Student Success at Temple University's Center for Research in Human Development and Education (CRHDE), and the U.S. Department of Education.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY
C. M. Achilles
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
2A

* The authors wish to thank many other persons connected with class-size research, especially H. Pate-Bain, J. Boyd-Zaharias, A. Molnar, P. Egelson, P. Harman, and personnel in Burke County, NC. K. Schwengel provided stories and examples of teaching in a small class based on 10 years of experience. Some findings from STAR and related class-size studies have resulted from continuing analyses supported by a Spencer Foundation Grant entitled: "A Study of Class Size and At-Risk Students."

EA 031206

BEST COPY AVAILABLE

The Varieties of Small Classes and Their Outcomes

Abstract

The federal class-size initiative and programs such as Wisconsin's Project SAGE provide funds for a variety of "small-class models," including intact small classes with one teacher, team-taught classes with 30 or more students and two full-time teachers, "push-in" or "pull-out" classes with 25-30 students and an additional teacher who works with small groups of students for part of the school day, and other options. The latter models change the pupil-teacher ratio (PTR) but not the actual class size (CS).

This paper summarizes the research evidence regarding achievement outcomes under these different arrangements, and compares the evidence on PTR and CS generally. It addresses key questions including: Is there a knowledge base from which to draw conclusions about these different classroom organizations? Is there evidence on PTR and CS generally from which inferences may be drawn about their relative effectiveness? What experiences have teachers reported when teaching under these different models? Does research provide a set of principles that would explain why the different models may be more or less effective in terms of student achievement or behavior?

Introduction and a Caveat

The abstract (above) describes the challenge for this paper, and a later portion of the paper does discuss some of the varieties of "small classes." Except for a day-long small class with one teacher who is responsible for the small-class students, the "varieties" described, however, are NOT small classes. They are pupil-teacher ratio (PTR) options. Considerable detail about the differences between PTR and class size (CS) is in Appendix A and an understanding of Appendix A is a pre-condition for understanding this paper. The class size is the number of students. If there are 30 students in a room with one teacher, the CS is 30; if there are two teachers with the class, the CS is 30; if there are 10 teachers, the CS is still 30. Confusion on this point and continuing use of the terms and concepts as the same rob children of excellence in education and make a mockery of serious research on class size and its effects. If the terms are used correctly, research on class size and research on PTR can be compared and contrasted. Rather than write a new section on this issue, we've included portions of a letter

from Achilles (11/6/00) to Professor Alan Krueger who does serious research using the STAR (Student-Teacher Achievement Ratio) database of some 11,600 youngsters.

Hi Alan:

I read your 9/2000 paper, "Economic Considerations and Class Size" and believe that I understand (most of it). Two issues concern me. Issue one is with your footnote 10, both in the definition and in the potential for under-estimation of class-size effects.

For many reasons that we might want to discuss, to an educator class size and pupil-teacher ratio (PTR) are not "primarily a question of how one aggregates the micro data," a condition that may be true for econometric analyses. As we have shown in some (ongoing) studies, the difference in class size and PTR is about n = 10; if the PTR in a building or district is 17:1, most teachers will have class sizes of about 27. Setting this reasonably large difference aside, the processes that occur in the small class, versus the PTR condition, are dramatically different, as are the general activities in the school. In the PTR event, kids are "pulled out" of classes and run up and down the halls (time off task) to spend time with some "specialty" teacher. More often than not (based on observations and interviews) the youngster leaves the "home" class in the middle off a lesson--and returns in the middle of a lesson--effectively missing two lessons (a difficult problem for already at-risk students). In addition, the comings and goings disturb the "home" class twice. Which teacher is responsible and accountable for the student who is in transit?

Here we have a perverse example of Lazear's Theory as you present it (p. 19). This student for whom PTR services are provided, the student pulled out of the "home" class not only has his/her education disrupted as described, but this student who was supposed to benefit from PTR now disrupts the rest of the class twice (out and in). Note that Boozer and Rouse (1995) found that, on average, at-risk (black) students were in schools with better PTR but larger classes, and they found only a small correlation (.13) between PTR and class size.

And from STAR, we learned that class size as an effective "treatment" is not randomly applied; it must start early (when this student enters school), be intensive (each day, every day, all day), and be of reasonable duration (3-4 years) to have a lasting impact.

From "macro" analyses, we now know that PTR interventions such as Title I don't work well (Abt, 1997; Borman and D'Agostino, 1996; Wong & Meyer, 1998). We do know that class size, employed as described above, does provide clear benefits (STAR; SAGE; Burke County; Fairfax County, VA) and "class size," employed willy-nilly, gets minimal (e.g., PTR) results (California, Nevada, Detroit, Houston, etc.).

If the two terms are not the same, why would they be interchangeable? Is this just a difference in specification by discipline--economics VS education? The terms are computed differently (addition VS division) etc. Appendix A points out some major differences. To say that PTR and class size "move together" so they can be substituted is to miss the point of what the two terms mean relative to education practice. Height and weight move together. "Hey Joe, how much do you weigh?" "About 6 ft. 9 inches." Great. Real clear! N_20 and H_20 look much alike: Both have two molecules of a gas that combine with one molecule of another gas (oxygen). A chemist (without N_20) would laugh if you suggested that these were interchangeable, the "only" difference being the N or the H.

Levity aside, the differences in PTR and class size are much deeper than "how one aggregates the data." Without following what we know about how PTR and class size are

different in application, even the "class size effect" won't be as strong as if the implementation is "ideal" as the Fairfax County study showed.

I know that PTR is used because it is quite easily obtained from large databases. It should, then, be called PTR. Serious class-size studies should proceed. Then, we might compare the result of both types of studies. Are there drawbacks to this sort of approach?

My other objection with your assumptions (and those of many others) is that small classes are expensive "... class size is necessarily worth the additional investment..." (p. 18). We have examples of small classes (n = 12-14) at little or no extra cost. (Burke County, the Downtown School). This is possible because of the difference between PTR and class size. The change is affected by reallocation of personnel. If the building has a PTR of 14: 1, it is clear that by allocating personnel, one could get class sizes in the 15-16 range, not on the 24:1 that we expect based upon the study we are and have been doing. Those other teachers also have space. Given a low cost of implementing small classes correctly, would this have an effect on your 6% figure later?

Sincerely,

Meta-analyses in the late 1970's (Glass & Smith, 1978; Smith & Glass, 1979) triggered a modern-day round of interest and activity in class-size research and practice. Prime Time in Indiana (Chase, Mueller & Walden, 1986) and the DuPont Study in Tennessee (Whittington, Bain, & Achilles, 1985) preceded Project STAR (Student Teacher Achievement Ratio) that was a longitudinal statewide randomized experiment to determine the effects of small classes (about 13-17 pupils per class) on student achievement and development in primary grades (K-3). Later analyses have explored the large STAR database (11,601 students) to try to answer questions that the STAR study and databases made possible, such as long-term results from early small-class participation.

The STAR results showed that students in Small (S) classes (13-17) performed better on both Norm-Referenced Tests (NRTs) and Criterion-Referenced Tests (CRTs) than did the randomly-assigned students in Regular (R) classes (22-25) and Regular-with-Aide (RA) classes. This was true each year, K-3, and minority students derived about twice the benefits that non-minority students obtained (Finn, 1998, pp. 9-10). The within-school design and STAR processes left no doubt that there was an important class-size effect. Analyses by Krueger

(1998) detected a class-size effect even in the control group, the (R) classes, such that students in smaller (R) classes outperformed those in larger (R) classes (p. 36). Boyd-Zaharias et al. in Chance (1995), employed correlational analyses on the STAR data by class size and found a correlation for student achievement and class size of approximately -.29 for reading and -.25 for math (p. 119).

Later analyses of STAR data using Hierarchical Linear Models (HLM) have shown that early gains in (S) not only continued many years after students left the small-class treatment (Finn & Achilles, 1999; Nye, Hedges, & Konstantopoulos, 1999; Finn, Gerber, Achilles, & Boyd-Zaharias, 2000), but that gains grow after students leave (S) and continue throughout schooling (Finn & Achilles 1999; Finn, Gerber, Achilles, & Boyd-Zaharias, In Press). Similar class-size effects have been detected in other well designed and conducted class-size studies such as in the Fairfax County (VA) School District (FCSD); Burke County, NC; and as reported by Molnar et al., (2000) Project SAGE—Student Achievement Guarantee in Education—in Wisconsin.

Although the research leaves an inescapable conclusion that small classes cause improved student performance (McRobbie, Finn, & Harman, 1998, p. 1; Finn & Achilles, 1990 & 1999), educators wonder WHY the (S) classes work to improve student achievement. Built chiefly upon observations in classrooms, teacher stories, and other research on teaching and learning, Achilles, Finn, Gerber, Pannozzo & Boyd-Zaharias, (2000) have posited some 17-20 theories (to date) to help explain why small classes work better than do larger classes to help students achieve. Additionally, initial analyses of STAR data (Word et al., 1990), analyses of Project Challenge (Achilles et al., 1995) and of student outcomes in later grades after students left the experiment in grade 3 (e.g., Finn & Achilles, 1999; Boyd-Zaharias & Pate-Bain, 2000;

Krueger & Whitmore, 1999) helped define the "correct" way to implement (S) for positive and enduring effects of small classes in early grades. These "correct" ways reflect information derived from two other longitudinal studies, the Perry Pre-School Study (n=109) and the Abecedarian study in NC (n=123). The "correct" ways to use small classes are shown in Table 1, based upon the studies mentioned above.

Table 1. Important Considerations for Implementing Small Classes, K-3.

1. Early Intervention. Start when the pupil enters "schooling" in K or even pre-K.
2. Intense Treatment. All day, every day in the small class. Avoid Pupil-Teacher Ratio (PTR) events, such as "pull-out" or team teaching.
3. Sufficient Duration. Maintain the small class for at least 3, preferably 4, years for enduring effects.
4. Use random assignment in early grades to facilitate peer tutoring and problem-solving groups (STAR).
5. Employ a cohort model for several years so students and teachers develop a sense of family or community (STAR).

The Varieties

Invariably, school administrators and teachers find reasons to try to improve upon the use of (S) classes, or else reasons not to use (S) classes. Some reasons include personnel shortage, space problems, tradition, not believing the research, thoughts that (S) will be too expensive, etc. There are differential effects of the (S) experience so that minority, male, poor, and difficult-to-teach students get more benefit from (S) than do "average" or above students. Wenglinsky (1997) concluded that: "fourth graders in smaller-than-average classes are about a half a year ahead of fourth graders in larger-than-average classes (p. 24) . . . the largest effects seem to be for poor students in high-cost areas." (p. 25, Emphasis added). Some interpret this to mean that not all students need (S) in the early grades. (So, should we segregate students by the variables listed above and run more Title I-like events in schools?). Is Title I successful?

Finn and Achilles (1999, p. 105) have discussed the CS/PTR issue.

> Researchers who compare class sizes and pupil-teacher ratios directly have found that class size is more strongly connected with academic achievement than is pupil-teacher ratio (e.g., Boozer & Rouse, 1995; Ferguson & Ladd, 1996). These findings are also not surprising. Pupil-teacher ratios do not usually characterize the setting in which most students spend most of their school day. When the pupil-teacher ratio is computed for a school or district, it does not describe variation among classes within the unit or even whether some classes are very large or very small. That pupil-teacher ratio is not strongly related to students' academic performance does not refute that class size is!

Some varieties in employing "class-size" strategies are more like PTR than CS, and without precise attention to the number of students in a classroom and studying the instructional processes, it is impossible to determine exactly if a reported variety is really CS and not PTR. In STAR, the (S) conditions were established by random selection. About half of the Regular (R) classes had full-time aides; the (RA) setting was a type of PTR. The RA condition typically was less productive than the (S) or (R) conditions (Finn, Gerber, Farber & Achilles, 2000, p. 5).

The CEIC Review (2000, March) includes three descriptions of "small-class" treatments (anecdotal evidence) that do not fully allow a clear statement about class size or/and PTR activities. Hanson (2000) explained the processes used in Flint, Michigan to create a "learning community" in Gundry Elementary, a K-5 school in a lower-income area (pp. 16, 20). Cotton and Linik (2000) explained a "part-time class-size reduction at Fall City Elementary" (p. 17). Howley-Rowe (2000) discussed a class-size reduction in Franklin, Tennessee: Johnson Elementary school: A Case Report (p. 18). Molnar et al., (2000) described class-size implementations in Wisconsin's Project SAGE (pp. 12-13).

Nagel (2000) described one early class-size (PTR?) effort in California. "Class-size" reductions (CSR) in Nevada have used some PTR models, often with 30-35 students and 2 teachers (with modest results). Achilles, Kiser-Kling, Owens, and Aust (1994) and Kiser-Kling (1995) described a true class-size effort in a year-long observation study called Success Starts

Small (SSS) in which they studied teaching processes and outcomes in matched schools in classes of 12-14 and in classes of 23-26.

Finn, Gerber, Pannozzo et al., (2000) evaluated the first year of the Buffalo, NY Public Schools' implementation of Federal and state CSR initiatives. The guidelines for the various programs and the perceived needs of students in schools resulted in several "models" for CSR that the evaluators condensed into five models. Table 2 shows these.

Table 2. "Class-size" Models Used in Buffalo, NY.

These guidelines, especially as applied in particular schools with particular needs, resulted in a number of instructional models across the Buffalo schools. For purposes of the evaluation (and this report), we have condensed the many variations into five basic models:

- **New-small classes** had 20 or fewer students taught by one teacher. The classes were created and the teachers hired specifically for the CSR project.
- **Existing-small classes** had 20 or fewer students taught by one teacher. These classes existed prior to the implementation of the CSR project but had an enrollment greater than 20 students at that time. When students were removed from these classes to create new classes, the enrollment dropped to below 20.
- **Team-taught classes** had two full-time teachers sharing responsibility for one class of students, usually with a relatively large number of students.
- **Push-in or Pull-out** classes are characterized by a teacher rotating between or among two, three, or more classrooms throughout the day, usually working with small groups of students. A 'push-in' teacher usually worked in a corner of the classroom, and a 'pull-out' teacher removed students from the regular classroom to work with them in the hall or a spare room (Finn et al., 2000, p. 1).

Many studies, usually with the minimal results characteristic of PTR outcomes, have called their findings "class size" results. Other groups contemplating serious attention to CS ideas confuse PTR and CS in their discussions. (See examples on the following two pages: There are more). The STAR researchers have explained key concepts about implementing small classes in numerous papers and articles, such as Achilles and Finn (2000), "If You Believe the Research, Why Not Use it Correctly," and "Implementing Small Classes: There Are Right Ways," (1999) and "How to implement Small Classes in Elementary Grades: A Manual" (1999).

CLASS SIZE REDUCTION

A Report of the Ad Hoc Class Size Committee

Prepared for the Board of Trustees of the Pleasanton Unified School District

October 10, 1995

Committee members

Administrators
Kevin Johnson
Steve Maher
Jim Negri
Sally Rayhill

Parents
Philip Bowman
Janice Cain
Judy Dollard
Louis J. Dunka, Jr.
Terry Damlos-Mitchell
Karen Geary
Margie Hayes
Tami Jansen
Alexander McMahon
Natalie Nonn
Ruth Preissman
Jennifer Sabella
Nora Sabhlok
Christopher H. Schmitt, chair
Marti Starnes
Kristen Weaver

Teachers
Sandra Hirst
Sarah Hollister
Susan McArdle
Mary Reding
Kelley Sandler
Sally Stock

Class size soon became a regular topic of discussion at trustee meetings. On May 23, 1995, trustees appointed a 26-member Ad Hoc Class Size Committee of parents, teachers and school administrators to study the issue and make recommendations.

HOW BIG IS BIG?

✓ California has the largest classes of any state in the nation, and Pleasanton has some of the largest classes in California. (Figure 1 and Figure 2).

Figure 1: CLASS SIZE – CALIFORNIA VS. OTHER BIG STATES

State	Pupils enrolled per teacher *	National rank	Percentage above/below average
California	24.1	1	+39%
Michigan	19.2	6	+11%
Florida	18.2	10	+5%
Ohio	17.5	14	+1%
U.S. average	17.3	—	—
Pennsylvania	17.2	19	-1%
Illinois	17.1	20	-1%
Texas	16.2	32	-6%
Massachusetts	14.9	43	-14%
New York	14.5	46	-16%
New Jersey	13.6	49	-21%

NB → * – "Pupils enrolled per teacher" means total enrollment divided by total full-time equivalent teachers. "Teachers" includes regular classroom teachers plus all other certificated personnel. NB ←

Source: Based on *Rankings of the States, 1994*, by the National Education Association, via EdSource of Menlo Park.

Notably, Texas and Massachusetts, two states which are key economic competitors of California, rank significantly ahead of both California and the nation. While these statistics do not indicate actual number of students per class, they provide a good yardstick of comparison among the states. The high number of students per teacher in California is an indication of large classes in this state relative to the nation.

BEST COPY AVAILABLE

The Nevada Class Size Reduction Evaluation Study 1995

Executive Summary

This evaluation report is an analysis of the effects of the Class Size Reduction Act which was passed by the Legislature in 1989. This Act called for a reduction in student to teacher ratios for selected kindergarten classes and for first, second and third grade classes, to be phased in over a period of years. A district average of a 15 to 1 student to teacher ratio was mandated for these grades. At this time the program has been implemented through second grade. This evaluation focuses on second grade students although some data for third and fourth grade students was also used. In general, the range of all actual class sizes has decreased over the years the program has been in effect. This study demonstrates that student to teacher ratios have been successfully reduced since the implementation of the Act and presents the following findings:

Next Grade Performance

A primary purpose for reducing the student-teacher ratio in the early grades is to make students more successful in their education in later years. In this analysis third grade students who had attended second grade in Nevada ware compared with those who had not and second grade students who had attended first grade in Nevada were compared with those who had not done so. The results were:

- Students who attended Nevada schools during the second grade had significantly higher third grade reading and mathematics scores than did students who did not attend second grade with reduced sized classes in Nevada or for whom second grade attendance could not be determined by the teacher.

- Students who attended Nevada schools during the first grade had significantly higher second grade reading and mathematics scores than did students who did not attend first grade with reduced size classes in Nevada or for whom first grade attendance could not be determined by the teacher.

Third Grade Performance and Attendance in Nevada Second Grade for Subgroups of Students

- Special education students in rural and Washoe schools showed some evidence of benefiting from attending second grade in Nevada. Their mathematics scores were significantly higher in 1993 and their reading scores were significantly higher in 1994. There were no significant differences by second grade attendance for special education students in Clark County.

- In 1993 third grade students in the rural and Washoe districts who were eligible for free or reduced cost lunch scored higher in mathematics but lower in reading if they attended Nevada schools in second grade. There were no significant differences for these students in 1994 in any of the districts.

- While students enrolled in the ESL programs had higher reading and mathematics scores if they attended Nevada schools in second grade, the differences were not significant in either year.

- Third grade White students tended to score significantly higher in reading and mathematics if they attended second grade in Nevada schools. Students of other ethnic backgrounds either showed no difference by second grade attendance or the results were mixed.

- In 1993 females scored significantly higher in reading if they attended Nevada schools in second grade, males scored significantly higher in both reading and mathematics if they had attended second grade in Nevada. hi 1994 females scored significantly higher in both reading and mathematics if they had attended Nevada schools in second grade; males scored higher in both subjects, but not significantly so.

Class Size

For the purposes of this evaluation a student-teacher ratio of 15 or less to 1 was defined as "small" and a student-teacher ratio of over 15 to 1 was defined as "large". It should be noted that the differences between these two class size classifications are, in reality, very small. There were fewer extremes in actual class sizes in the second grade in 1993 and 1994 than there were in 1992. Another factor is that the smaller ratio classrooms in 1993 and 1994 tended to be team taught rather than self-contained.

- In 1993 smaller second grade classrooms were associated with higher mathematics scores, but lower reading scores in the rural and Washoe districts. In Clark there were no significant differences in reading or writing scores by size of class.

?

- In 1994 smaller second grade rural and Washoe classrooms were associated with lower reading scores but mathematics scores were not affected by classroom size.

Classroom Configuration

The two major types of classroom configurations in the second grade classes were self-contained and team taught. Self-contained means one teacher and students in a classroom; team taught means two teachers and their students in one classroom.

- In 1993 in second grade rural and Washoe districts, self-contained classrooms were associated with higher reading scores but lower math scores. In 1994 self-contained classrooms were associated with higher scores in both reading.

BEST COPY AVAILABLE

What Are Teacher Outcomes in Small Classes? *

Some evaluations contain questionnaire responses from teachers and other educators about their impressions of CSR (e.g., Nevada Department of Education, 1993 and 1995; Finn et al, 2000, August). In some cases, the study does not make clear whether the CSR was CS or PTR. Tables 3-5 provide a collection of teacher responses from Nevada, Wisconsin, and Olson's 1950's study. In Nevada and Wisconsin, a considerable portion of respondents were in PTR treatment because of space problems. Even here, though, responses seem positive.

Table 3. Nine Defensible Generalizations About Class Size When Teachers Have Fewer Rather Than More Students. [From Cavenaugh, R. (1984, March). Class size and best practice. Education Alternatives. 3. Dr. Martin Olson's breakthrough study in the USA nearly 30 years ago focused on the impact of different class-size groupings.]

1. Teachers employ a wider variety of instructional strategies, methods and learning activities and are more effective with them;
2. Teacher attitudes and morale are more positive;
3. Classroom management and discipline are better;
4. Students benefit from more individual instruction;
5. Students develop better human relations and have greater regard for others;
6. Students learn the basic skills better and master more subject matter content;
7. Students engaged in more creative and divergent thinking processes;
8. Students learn how to function more effectively as members and leaders of groups of varying sizes and purposes;
9. Student attitudes and perceptions are more positive. (Source: Dr. Martin Olson)

Table 4. Findings on Teaching Characteristics in Small Classes in Project SAGE (Molnar, 1998, p. 37).

In their qualitative research, evaluators found that in SAGE classrooms:

1) Little time is required to manage the class or to deal with discipline problems;
2) Much time is spent on instruction, actively teaching;
3) A large portion of instruction is individualized and spent in diagnosing student needs, providing help, and in monitoring progress; and
4) Students showed increases in "on task" and "active learning" behaviors over the year.* These behaviors were also found to be related to SAGE student performance on the CTBS.

* This finding is similar to the increase in time-on-task found in Success Starts Small (SSS) in North Carolina.

* Considerable portions of this section are from Achilles, Egelson, and Finn (1998), pages 8-18, and some information has also been reported in Achilles (1999).

TABLE 5 Pages from Nevada (1995) Class-Size Evaluation, Part 2, pp. 7-8.

SECTION 2: OPINIONS OF CLASS-SIZE REDUCTION

Principal response

Response of principals throughout the entire state to the questions about the extent to which CSR has resulted in positive changes (answer choices 4 or 5) is shown below. To 18 of the 23 items, the percent of positive response was greater than that recorded in 1992. Principal response was as follows:

	Percent Positive Response
• student-teacher interaction	96.4
• monitoring student progress and providing feedback to students	97.6
• the amount of teachers' paperwork and recordkeeping*	71.4
• the number of discipline problems referred to your office*	79.5
• the pace of instruction	80.2
• the amount of time allocated to instructionally relevant activities	88.5
• student time-on-task	91.6
• student learning	93.3
• opportunities for your teachers to explore and use new/different teaching strategies	88.0
• cooperative activities among teachers	79.6
• principal-parent contacts regarding discipline problems	64.6
• teacher-administrator interaction	55.1
• student morale	83.7
• teacher morale	87.9
• small-group instruction	94.6
• physical space	50.0
• use of hands-on activities and manipulative materials	92.1
• teacher planning and preparation	76.1
• social interaction among students	71.6
• social/personal interaction between teachers students	89.7
• use/effectiveness of enrichment activities	89.1
• parent-teacher contacts	76.5
• one-to-one instruction	95.2

* These three questions are considered flawed. Some principals chose answer choice 1 or 2 to indicate that teachers' paperwork and the number of discipline problems parent contacts declined, while others chose 4 or 5 to indicate paperwork and discipline problems have improved (but not increased). Therefore a positive response for these two questions is the total of numbers 1, 2, 4 and 5.

REPORT PREPARED BY
TESTING AND EVALUATION DEPARTMENT
CLARK COUNTY SCHOOL DISTRICT

Judith S. Costa, Director February 1995

Rhoton Hudson, Teacher Specialist

Teacher response

The responses of first- and second-grade teachers from the entire state to the questions about the extent to which CSR has resulted in positive (answer choices 4 or 5) changes are reported below. First-grade teachers responded more positively than in 1992 to 18 of the 23 questions, while second-grade teachers responded more positively to 21 of the 23 questions. Teacher response was as follows:

	Percent Positive Response 1st Grade	2nd Grade
• student-teacher interaction	93.1	92.0
• monitoring student progress and providing feedback to students	94.2	93.7
• the amount of paperwork and recordkeeping*	78.3	76.9
• the number of discipline problems*	75.7	74.6
• the pace of instruction	78.2	74.7
• the amount of time allocated to instructionally relevant activities	82.0	78.5
• student time-on-task	83.2	82.3
• student learning	89.4	88.6
• opportunities for you to explore and use new/different teaching strategies	92.8	88.5
• cooperative activities among teachers	74.1	75.8
• your interaction with other teachers	62.5	65.2
• teacher-administrator interaction	40.1	40.9
• student morale	83.5	80.3
• teacher morale	86.8	82.8
• small-group instruction	91.1	91.3
• physical space	59.6	56.3
• use of hands-on activities and manipulative materials	82.1	83.1
• teacher planning and preparation	65.6	65.0
• social interactions among your students	78.9	74.8
• social/personal interaction between teachers and students	87.0	84.3
• use and effectiveness of enrichment activities	86.9	85.1
• parent-teacher contacts	72.3	64.5
• one-to-one instruction	92.2	90.8

* These two questions are considered flawed. Some teachers chose answer choice 1 or 2 to indicate that paperwork and the number of discipline problems declined, while others chose 4 or 5 to indicate paperwork and discipline problems have improved (but not increased). Therefore a positive response for these two questions is the total of numbers 1, 2, 4 and 5.

In Success Starts Small (SSS) Achilles et al., (1994) observed that in 1:14 classes teachers were "on task" far more than were teachers in 1:24 classes throughout the year, ending in the spring at about 89% (S) and 67% (R) time on task. Clearly, this time-on-task difference translated into the statistically significant differences in achievement and office referrals (discipline) favoring the 1:14 condition. (As reported in Achilles, Egelson, & Finn, 1998, pp. 20-21).

Table 6 (a two-part table) shows teacher observations about teaching in small (1:15) classes and in larger (1:24) classes. Interestingly, the teachers completed the 1:15 responses while in 1:15 classes and then all four were assigned the next year to 1:24 classes. They had been in 1:15 classes because their principal that year put all Title I money into CSR in the 73% Title-I eligible school. The following year a change of administration required the usual "pull-out" model (PTR) in Title I, so the prior 1:15 (K-2) school became like its "control" school in the SSS, a school of 1:24+ and pull-out projects.

[TABLE 6 ABOUT HERE]

The idea of using Title I funding to achieve a true CS of 1:14 –1:18 or so is productive. S. Etheridge (Personal Communication, May, 2000) explained how, in his role as Title I director in Berkeley County, SC he uses Title I funds to achieve small classes (CS). Here are some quotes from his letter. We are waiting for a report of student outcomes.

> My summer program, LEAP-99, Learning Enhancement for Academic Preparation, received the SCASCD award this month for exemplary program design . . . Leap-2000 is going to be bigger and better. Class sizes for LEAP are held at twelve students . . . Of 157 first grade classes this year, I used a variety of funding sources and maintained an average 12.26:1 class-size . . . Late enrollments (after the 90-day count) caused four classes to go to 16 but all others stayed at 15:1 or below.

Table 6 Project Success-Progress Report (3/17/93). These results are from confirmed small-class (1:14-1:16) observations (4 classes).

A. Immediate observable outcomes of class size of 15:

1. More individual attention
2. More personal space for each student
3. More personal teacher-student conversations
4. More time to diagnose how the students are thinking and to determine their understandings and misunderstandings
5. More time to diagnose and develop their most successful learning style
6. More time to get to know each student and their families - a message to parents that teacher really cares because she knows all about us
7. More time for students to get to know each other
8. More time for teacher to develop sense of community among classmates, connect her students with other big sister/big brother classes in the school
9. More students reading on more advanced levels.
10. More students understanding math concepts, not simply writing numbers and number facts
11. All students participating in "Seminars" discussing literature on their level, making concept connections and thinking about human values
12. More self confidence for learning regardless of abilities
13. Wider range of abilities able to learn together (fewer referrals out during these critical early years)
14. More time and space to develop hands on/student initiated learning rather than relying on mostly didactic, teacher controlled learning
15. More time to give "troubled kids" the attention they so desperately need, reducing greatly the likelihood of their becoming a discipline problem
16. More energy for collegial planning that led to well thought out, creative "webbing" thematic lessons
17. A sense of peacefulness in the class

Table 6 (continued)

B. Immediate Observable Outcomes of Class Size of 24: Results after small-class teachers (part A) had returned to larger classes.

1. I cannot meet all subject needs daily.
2. I used to have daily reading conferences. Now I read individually with each child about two times weekly.
3. I feel frustrated that in the critical first grade year, I cannot assess their reading individually and specify the focus they need.
4. They used to read to me every day. They still want to and it seems to hurt their feelings if they can't.
5. This at-risk population needs daily help. I want to give that help but can't get to them as often as they need.
6. I don't know the children as well.
7. During each lesson now, each child does not get to answer. Last year, each child answered three and four times in each lesson.
8. Lessons are 15 to 25 minutes longer as I check all children. I do more "up front" teaching. This leaves little time for students to do the independent exploratory learning and thinking.
9. There are more student conflicts in the classroom.
10. There is less space for each child.
11. I have to move on before all students have learned. Last year I could make sure every children did and learned what he or she was supposed to.
12. Students do not present their work orally as much. Oral communication is a major need, but the class size keeps us from doing it as much.

Small-Class Lessons from Burke County, NC (Achilles, Egelson, & Finn, 1995, pp. 8-13).

Burke County, North Carolina educators began small classes on a pilot basis and then expanded the program so all students in grades 1-3 were in classes of 13-15 students per teacher. Over the years of the small-class implementation, the teachers have cooperated and shared successful teaching practices. Because of the small numbers of students in each class, teachers could individualize much of their instruction and use student portfolios as a teaching strategy, a way to monitor student performance and growth, and a centerpiece for involving parents. The

teacher uses of the portfolio in Burke County show how small classes facilitate improved teaching and learning.

A small class gives the teacher time and space to teach well. Small classes trigger changes in categories of schooling activities: teachers can expect the following positive outcomes in classroom management, in parent interest in school, and in curriculum and instruction. Burke County teachers provided these examples.

Selected Positive Aspects of Teaching in Small (1:15) Classes

- Individualize programs for students on their levels
- Reading instruction is more varied and successful
- Increased time-on-task
    - Individual reading time, daily;
    - Reading logs, with time to monitor student growth;
- Teachers can monitor and use volunteers well
- Teachers can bond with each student and increase one-on-one student contact
- Greater expectations and accountability at all levels

Parental Interest and Involvement in School Increase or Improve

- Frequent parent conferences and high attendance at parent meetings, such as at report card pick-up
- Newsletters (Each teacher sends a newsletter home 2-3 times each year)
- Parental involvement in classrooms, often as volunteers.
- Increase in Parent-Teacher Organization (PTO) attendance
- Pupil self-esteem is elevated by the "community" in rooms.

Classroom Management:

- Many fewer behavior problems and stronger peer relations
- Environment and space are safe and conducive for learning
- Small-group instruction is more manageable than in larger classes

Changes or Increases in Curriculum and Instruction, such as:

- Frequent individual reading and writing conferences
- More hands-on activities, especially in math and science
- Teachers can use inventories to monitor students' active learning.
- Observable increases in computer lab/media, interest and use.
- Establish a pattern of early success in school

- Added portfolio use improves the alternative and authentic assessment of student growth

Portfolio Process as Example of Small-Class Benefit

When used properly, the portfolio process is time-consuming and individual-intensive. In a small class, a teacher can use a portfolio not only to collect and display student work, but also as a teaching tool and communication bridge with the home. Small classes afford the time and space for working on and storing the portfolio. The portfolio process is an important part of instruction, and several teachers from Hillcrest Elementary School in Burke County shared some of their ideas about portfolios in a small class. Observations in small classes in the Clovis (CA) schools provided results similar to those reported here.

Basic Steps to Portfolio Assessment

- Decide what language arts, math, and other competencies are most important to you and to your students.
- Determine specific tasks to demonstrate the important competencies.
- Define standards of student performance.
- Implement a method for managing the portfolios.
- Evaluate the portfolios at regular intervals, jointly with students (and parents).

Encourage each student to review his/her portfolio at specific times to assess the work and to think about personal growth and achievement. A student "Portfolio Self-Evaluation" worksheet will help the student in maintaining a "portfolio process' and will guide reviews of the student's work. Reviews can also be a part of parent, teacher, and student conferences.

With a class of 28-30 children many aspects of good teaching, especially the time-consuming individualization required in using the portfolio process as the heart of instruction, are not manageable. Whether a teacher uses portfolios or some other individualization process, the small class makes teaching and learning a more meaningful and productive event; large classes hinder teachers from doing what they know how to do.

The following material is from Achilles et al., (2000, October, pp. 24-26), a paper on reducing the test-score achievement gap. This shows how student test scores changed as the Burke County CS event proceeded, 1991-2000.

The Burke County, North Carolina, Class-Size Effort.

Burke County is a relatively low-wealth system located in Western NC in the foothills of the Great Smoky Mountains. As it has grown, the school system has experienced an influx of limited English proficient (LEP), English as a Second Language (ESL), and low SES youngsters.

Table 7 shows the changes, 1992-1993 through 1997-1998: school population increase of 11% (12,400-13765), Free lunch increase of 45%, LEP increase of 423%. Title-I schools where at least 50% of the students qualify for Title I increased from one (1995-95) to five (2000); and seven other schools are served with targeted Title I efforts because the percentage of eligible youngsters is equal to or greater than the county average.

To counter low student test scores, Burke County Schools (BCS) initiated class-size reductions in grade one of four pilot schools (1991-92). Results were good, so in 1992-93 small classes (about 15:1) were begun in grade one of all 14 elementary schools and in grade two at the four pilot schools. By 1994-95 the initiative was in grades 1 and 2 at all 14 elementary schools, and by 1995-96 into grades 1-3 at all schools. This small-class phase-in was done with local funds by creative reallocations and re-assignments in a low-wealth district. (Stewart, 1998: Achilles, Egelson, & Harmon 1995).

Table 7. Student Demographic Changes, Burke County, NC 1992-93 to 1998-98: Population, Limited English Proficiency (LEP), Free Lunch (FL) and Title I Eligible.

	1992-93 n	1997-98 n	Growth n	Growth %
(A) Population	12,400	13,765	1365	11
(B) Free Lunch	3583	5199	1616	45
%B/A	29	38		
(C) Limited English Proficient (LEP)	217	1135	918	423
% C/A	2	8		

Most students who started school in BCS in grade one in 1992 and all students who started in 1993-94 would have been in small classes, grades 1, 2, and 3. Measures reported here are results from North Carolina's end-of-grade (EOG) tests. The percent of grade-level students "proficient" by reason of scoring in levels 3 or 4, the top two levels of the EOG proficiency tests. Level 1, the bottom, includes students who are the least proficient, and who most need growth. A learning-achievement goal, then, is to greatly reduce or diminish the percentage of students scoring in level 1 and to increase the percentage of students scoring proficient, or in levels 3 and 4. By 1994-95 about half (most) of grade-3 students had small-classes in grades 1-3. By 1995-96 all BCS students had small classes in grades 1-3 when they took the Grade-3 EOG tests. Table 8 shows both the decline in level 1 and the increase in levels 3 and 4 (proficient) in the EOG tests for 1994-95 and 1995-96, a direct result of the small-class effort. The 1998 through

2000 results show that this increase was maintained despite the 11% increase in population, 45% increase in free lunch, 423% increase in LEP, and a large increase in Title-I students served.

Table 8. Burke County, NC EOG TEST Outcomes. Grade 3 (Stewart, 1998 & updated) *

YEAR that (MOST) or ALL students taking EOG Test could have had grades 1-3 in small classes.	Level 1 % Not Proficient		Levels 3 & 4 % Proficient	
	Reading	Math	Reading	Math
1993	13.4	10.9	60.3	61.6
1995 (MOST)	8.6	5.6	68.6	71.4
1996 ALL	5.9	4.7	74.0	75.9
1998 ALL	4.4	2.4	79.8	76.0
1999 ALL	4.0	2.9	78.1	75.7
2000 ALL	2.4	2.1	83.9	80.5

* Thanks to Burke County, NC personnel for compiling and sharing these results, especially former superintendent T. Stewart, and present personnel M. Church, S. Schwengel, S. Wilson, and T. Farris.

The early start in small classes has carried over into the later grades after students return to larger classes as shown by the EOG test in succeeding grades, 5-8. (Achilles et al., 2000, October, pp. 27-28). Each year that the cohort of students who had small classes in grades 1-3 took the upper-grades tests, there were obvious jumps in the percentage of students scoring proficient.

North Carolina Small-Class "Stories"

The teacher comments about benefits of small classes and the outcomes of a small class tell a story of teachers being able to teach and to do what successful teachers in STAR and in SAGE and in Olson's review all did: individual attention, work with each child, use the

advantages of space, and the opportunity to work with troubled students vs., generally not being able to do those things. The benefits expressed by teachers were confirmed by statistically higher test scores, fewer discipline cases sent to the office (reduced by 50%), by improved parent relations, and in other ways.

> ☺ The mutual respect between students and teacher was stronger than I have ever seen it. My students showed very positive gains in academics and in their computer skills. I was pleased to have more "quality" time to spend with my low achievers, as well as with my high achievers. Discipline problems were non-existent. Students and teachers loved the small classes.

Teachers in North Carolina told the same stories over and over. At a workshop on small-class instruction held in June 1998, teachers of small classes reported on their perceptions of small-class benefits. The consistency of their responses serves as an estimate of reliability not only internally for this group, but also externally when compared to results of studies and anecdotes from small-class teachers in other states.

- ☺ "The main advantage is being able to work one-to-one with more students. It helps maintain better discipline and students work as a family unit."
- ☺ "With fewer students, I can get to know a students' weaknesses and strengths quickly, and begin to address them."
- ☺ "More individual help to students.
  - More personal relationships.
  - Can build self-esteem.
  - Improved discipline.
  - More time for fun learning activities."
- ☺ "More time for individual help.
  - More opportunity to use technology.
  - More time for communication with parents about their child's progress.
  - Peer tutoring.
- ☺ "Small-class size enables me to get to know each student better, and to provide for the individual needs of the students."
- ☺ "Smaller classes for me have provided important benefits:
  - Closer personal relationship with students/parents.
  - More time for individual help.

- Time for whole-group, small-group, and individual reading classes."

☺ "Small classes allow me much more time for working with small groups and particularly for working closely with the students who require individualized instruction and individual attention."

☺ "Reduced class size has allowed me to engage my students in more active learning activities. There is more room and more time for dyad or small-group activities. Student's projects have improved because there are enough materials for everyone. I have enjoyed individual conferences with my students about their progress also. There is more of a "family feeling" within my class."

Appendix B contains extended notes and anecdotes about "Teaching Activities in a Small Class." The enthusiasm expressed in Appendix B was observed in 1:14 classes throughout the full-year observation study, SSS (Achilles et al., 1994; Kiser-Kling, 1995).

The "Real" Small Class, Grades K-3

"Class-size" outcomes such as those reported by Hanushek (1998,1999) and in early studies of "class size" really were summaries of PTR outcomes or secondary analyses of data sets or studies that were not specifically done for "class size." Title I as commonly operated is PTR; so are special classes, such as those for gifted and talented, AP, etc. Other PTR events include the models in Table 1 (p. 6) and the Abstract: pull-out, push-in, team teaching (for grades K-3?). The considerable PTR-based "class-size" research should be seen as research on PTR. This work continuously show meager PTR results (see Appendix A). There also are different outcomes depending on how the CS is implemented. Analyses of STAR data (Finn et al., 2000; Finn et al., In Press) shows the importance of early small-class intervention that is intense (all day, every day) and that it is of sufficient duration (at least 3 and preferably 4 years).

The Fairfax Count (VA) Public Schools (FCPS) evaluation of the class-size initiative demonstrated, by student test outcomes, the importance of what FCPS (1997) called "Ideal

Implementation." Table 9 shows the difference in student outcomes on 8 ITBS subtests between the 10 schools with "Ideal" and the 19 schools with "variations in" implementation of small classes. The "Ideal" schools averaged +3 scale-score gain in 8 subtests and the "variations" schools averaged 0 points of gain.

Table 9. (FCPS Report).

Table ES-3
Average Scale Score Change on 1995-1996 Grade 4 ITBS
When Compared to 1993-1994 Scores

ITBS Subtest	10 Schools with Ideal Implementation	19* Schools with Variations in Implementation
Reading Comprehension	+3**	0
Vocabulary	+2	-1
Total Language	+4**	0
Math Concepts	+5**	+1
Math Problem Solving	+2	0
Math Computation	+2**	0
Total Math	+3**	0
Composite	+3 **	0

* Markham and Cheney were not included in this analysis because there are no fourth grades in these schools.

** Significant $p < .05$

To date, evaluations of the largest U. S. experiment in PTR (Title I) have not been glowing (Abt, 1997; Borman & D'Agostino, 1996; Wong & Meyer, 1998). Observations, contacts in schools, and even a reading of the Federal CSR Guideline point out that the CSR

initiative as presently conducted is little but an extension of PTR as exemplified by the use of teacher aides and the present use of many "projects" (ala Title I). Does anyone care about CS research results unless they can interpret them to support doing more of the same? This is not a trivial question.

Remove the Barriers to Using Small Classes

Some complain that doing small classes is expensive. It surely can be if the only change is to add teachers and conduct staff development. On the other hand, if the building has a PTR of 1:12 and an average class size of 1:28, a carefully planned re-allocation of personnel can reduce the distance between PTR and CS (Miles & Darling-Hammond, 1998; Achilles & Sharp, 1998). The reallocation can be based on the changes and savings that occur from using small classes correctly: reduced grade retention, early identification and correction of learning problems, student success without special projects, improved behavior. . .

Why Does Class Size Matter?

Although STAR results stated clearly the cause-effect relationship between class size and student achievement and development, most serious-minded educators ask "why does a small class make a difference?" To date, STAR researchers and others have identified some 17-20 reasons why small classes provide improved student outcomes. These reasons are either well researched (e.g., time on task or group dynamics) or are tied to respected and useful theories (e.g., multiple intelligences, environmental factors). Table 10 presents reasons from research, theory and practice to support why CS is important and why it works.

These entries in Table 10 offer areas for speculation, observation, research. For example, we recently have completed one study on environment factors, a study of Indoor Air Quality (IAQ). The study showed ($p \leq .01$) that large classes (19 and more students) have higher levels

of CO_2 as the day goes along than do smaller classes (17 and fewer students). The CO_2 levels get oppressive by around noon and reach levels that would retard learning in the large classes (See Appendix C). That changing the number of bodies from 25 to 15 in a room will increase the space per student hardly needs a controlled study. Table 10 also serves as a partial summary for ideas expressed throughout this paper.

TABLE 10 ABOUT HERE

Recommendations

1. Research on class size and research on PTR are both useful. The research and evaluation on both should continue, separately. The treatments, variables, and processes in PTR and CS are not the same, so they should not be confounded and reported as the same.
2. A concerted effort should be made to educate the public, parents, policy persons, researchers, and the media on the differences between PTR and CS.
3. The U. S. Department of Education must be an advocate for the correct implementation of class sizes. This advocacy can be conducted by "staff development" and by gentle hints in the CS Initiative Guidelines. Department of Education documents and information on PTR and CS should use the terms explicitly.
4. Evaluators and researchers should document carefully the contexts in which students are educated so that issues of CS and PTR are evident.
5. Some "Ideal" implementations of CS need to be studied and evaluated, so there begins to be a substantial base of CSR data, where the event described is really CS.

Table 10. Theories or Research-Supported Factors that Help Explain the Small-Class Effect in Early Education for Young Students. (Grades K-3 or so).

RESEARCH, THEORY, BASIS and RATIONALE	Outcomes By Model: CS or PTR	
	"TRUE" Class Size (CS)	Pupil-Teacher Ratio (PTR)
I. LEARNING		
A. TASK INDUCTION. Schooling is 13-year "work" for young students. They need to learn to "do" school. (Homework, lessons, etc.).	A major key to success is knowing what is expected and how to succeed. Because of positive influences (all other entries here) a student learns school routines and learns to like "school." [3]	? No evidence that PTR even attends to Task Induction. [?]
B. TIME ON TASK. Mastery learning. Amount of time and time use (engaged) aid learning.	Research supports that student time on task in engaged learning leads to better outcomes. Smooth transitions between lessons and in other classroom activities. [3]	(See III D). Lots of time spent in "transition" from one teacher to another, or even from one lesson to another. Pull-out time is hall time! [1]
C. ENGAGEMENT, PARTICIPATION. IDENTIFICATION with school. See work by Finn, Rumberger, Voelkl, others—Engaged time, too).	In small classes there are high levels of engagement and participation (Finn & Cox, 1992; Achilles, 1999). Engagement leads to improved outcomes, better attendance, fewer discipline problems. [3]	? Much disruption, many transitions. Student may leave room after one lesson starts, and return in the middle of the next, missing two lessons, effectively. [?]
II. TEACHING		
A. ACADEMIC-INDIVIDUALIZATION. People learn in different ways. Multiple Intelligences (MI) Theory.	Teacher can work each day with each child, reading with and listening to each child, correcting problems, modeling behavior. Teacher can do individual planning (IEP-like) for each student. [3]	At best, teacher gets a little time with each child. Usually the "individualization" is 4-6 in-class groups, or in the part-time "special" or pull-out class. [1]
B. EARLY DIAGNOSIS OF LEARNING DIFFICULTY. If correctable problems are addressed early, student can avoid later problems and special education.	Because there is no-one else, each teacher MUST determine why a child isn't learning, and what to do about it. STAR showed relatively more early ID of special needs in (S) classes. Early, fast help may reduce later special ed. needs. [2]	STAR showed relatively fewer ID of special needs in classes with teacher Aides. Low performers were with assistants who may not be qualified to ID special needs. [1]

1 = Low. May not be present, or present to minimum degree.
2 = Middle ground. Perhaps some modest support
3 = High. Present and in observable high degree
? = Little evidence or information

(Table Continues)

C. TEACH TO MASTERY. Teachers should assure mastery before moving on.	Mastery is across the curriculum, as shown in STAR testing (Finn & Achilles, 1999). In STAR (S) classes reached mastery with 64 min. of lang., arts, vs 86 min. for (R) classes. [3]	Mastery is usually in one skill only (for each "project") rather than in all subject areas. Pullout models disrupt the normal flow of classwork. [1]
D. IMMEDIATE REINFORCEMENT. Reward good outcomes. Correct errors before they become habit.	The "teaching moment" happens, and the time to compliment or correct is THEN. Teacher can help student get it right so later practice and use will be correct. [3]	Teacher may not even know what happens in the other room, or group, etc., so reinforcement may not be provided, or it may be used inconsistently. [1]
E. ASSESSMENT (In-Class)	Teacher can observe and assess child daily and follow that students' progress. [3]	Work is usually pre-structured through the "project" format. Assessments may be "packaged." [1]
F. USE OF MORE TEACHING METHODS. Olson's observations. Achilles (1999) summary.	A mixed review. Much research finds teachers doing the same thing, but doing more. (Evertson, Folger, Filby). [2]	Teachers are often "locked in" to some rigid, scripted method in a project format. This can lead to impoverished, test-driven education. [1]
III. CLASSROOM		
A. CLASSROOM ENVIRONMENT (e.g.: AIR QUALITY, MATERIALS, SPACE/CROWDING). (Prout study; E. T. Hall, others)	One IAQ study showed high CO_2 concentrations in large classes. In small classes, each student has more space, materials, etc. than in larger classes. (People x space x stuff). Appendix C [3]	? Time in halls may improve fresh air and provide exercise options for students. [?]
B. PERSONAL ATTENTION/ COMMUNITY. Family-like; A learning-organization context; sense of support, help, "common good." Able to establish a sense of community.	Students get to know each other well. Teacher and student "bond." Increased parent and volunteer presence gives each student lots of adult attention (see III D, IV A). Students help and "look out" for each other. Teacher can work with each child as the child needs help. [3]	With large classes PTR folks spend lots of time and $ trying to get outside involvement. Teacher may not get to know students and families until late in the year. [I spoke with a (K) teacher who had half-day (K) with 32 children in the AM and 34 in the PM]. Real Personal! [1]
C. INCLUSION, SPECIAL NEEDS	Small classes allow the classroom teacher to make inclusion work. In a class of 15 a teacher can work with 2-3 special students. [3]	More pull-outs, less individual work in class. Inclusion becomes a problem as pull-outs add confusion. [1]

1 = Low. May not be present, or present to minimum degree.
2 = Middle ground. Perhaps some modest support
3 = High. Present and in observable high degree
? = Little evidence or information

(Table Continues)

D. GROUP DYNAMICS. Years of social science research on group size and interactions, outcomes, tasks, etc., support, use of various-sized groups for various jobs.	Teacher can plan and use time as needed in the groups. Groups can be made to fit tasks students need to do to learn. [3]	Kids are in/out of the room, breaking up meaningful group projects and efforts. Teacher has little control of group activity. [1]
E. OPPORTUNITY FOR PEER INTERACTION. Peers help each other learn (peer tutoring, etc.).	Community (see III B above) enhances students' willingness to interact. Frequent use of small-group work is evident in small classes. [3]	Little evidence except as "projects" require it — Interaction is usually one-on-one with teacher [1]
F. CLASSROOM MANAGEMENT. Teaching requires much effort and many tasks. The class must be safe and "conducive" to learning. (See III D and III G)	With fewer children, teacher can have fewer groups. Teacher can train and manage volunteers. Students can interact and the noise level is reasonable (15 vs 30). Transition(s) from task to task are "seamless." [3]	The PTR efforts keep a classroom in constant flux! IN/OUT. Commotion of push-pull disrupts planned events and the "flow" of learning. [1]
G. LESS INDISCIPLINE. With few disruptions there is more engaged time on task.	Small classes had about 50% of the indiscipline in "regular" classes (SSS, STAR, etc.), (perhaps partly because of space, group dynamics, etc.). [3]	Constant movement in transitions offer opportunities for "horseplay." [1]
IV. "OTHER"		
A. INCREASED PARENT INTEREST. Parent involvement improves student behavior and achievement in school. More volunteer help.	Every well done CS study has documented increased parent interest in child and school. There is more volunteering for important things, not just for "parties." [3]	? Most projects strain to include a "parent" component. [?]

1 = Low. May not be present, or present to minimum degree.
2 = Middle ground. Perhaps some modest support
3 = High. Present and in observable high degree
? = Little evidence or information

(Table Continues)

B. TEACHER/STUDENT MORALE/ENERGY. Smith & Glass (1979). Achilles (1999), Stories told by teachers.	Teacher morale and energy increase (Implications for substitutes?) Teacher and student positive attitudes are reciprocal. Less time on paperwork allows more time for planning. [2]	Large classes tire teachers and students. Higher noise levels and crowding are irritants. [1]
C. ACCOUNTABILITY and RESPONSIBILITY	In a small class, each teacher is responsible and accountable for the achievement, behavior, participation, citizenship, development of each student (1:15 or so). [2]	Kids go to various teachers for all sorts of "help." Who is responsible for the reading? For the math? For the behavior? (Includes classes with teachers Aides, too). [1]
D. ASSESSMENT (Outcome)	Every well done CS study has shown major student improvement in grades and in other outcomes. [3]	Constant low marks for Title I suggest policy should shift from PTR to class size. [1]

* An interesting task would be to compile a research, theory, and exemplary practice bibliography for each of the entries in this Table.

1 = Low. May not be present, or present to minimum degree.
2 = Middle ground. Perhaps some modest support
3 = High. Present and in observable high degree
? = Little evidence or information

Summary

Bain et al., (1992) summarized advantages of the small-class condition as expressed by the teachers in Project STAR. That summary expresses the general differences that teachers find between teaching in larger and in smaller classes. The class-size "differences" they expressed are really more of the same. Is "more" really different? The evidence mounts.

> A common benefit cited by teachers in small and regular-plus-aide classes was that they were better able to individualize instruction. These teachers reported increased monitoring of student behavior and learning, opportunities for more immediate and more individualized reteaching, more enrichment, more frequent interactions with each child, a better match between each child's ability and the instructional opportunities provided, a more detailed knowledge of each child's needs as a learner, and more time to meet individual learners' needs using a variety of instructional approaches (p. 254).

Note that this paper does not include details about teaching in small and large classes that were found in Project STAR (Word et al., 1990). The extensive STAR results that confirm experimental material reported here are provided in separate papers by STAR principal investigators. The stories of teachers of small classes today express just what reviews of early class-size studies found. Observations and quantitative data support these stories and anecdotes.

Author Notes

The authors thank the many who contributed material in this paper. Besides the teachers and students who provided the data and examples, project STAR researchers and staff (E. Word, H. P. Bain, J. Folger, J. Johnson, M. N. Lintz, J. Boyd-Zaharias, D. Fulton and others) have provided ideas and assistance. Naturally, any opinions, errors, or weaknesses in the material are the authors' own.

Major portions of the material are from Achilles, C. M., Egelson, P. & Finn, J. D. (1998, November). Teaching in small classes: What is the difference? Paper presented at the Mid-South Educational Research Association (MSERA). New Orleans, LA. November 5-7, 1998. ED431009. That MSERA paper became an important source of text for Achilles, C. M. (1999). Let's Put Kids First Finally: Getting Class Size Right. Thousand Oaks, CA: Corwin Press, Inc., especially chapters 4-7.

REFERENCES and BIBLIOGRAPHY

Abt Associates (1997, April). Prospects: Final Report on Student Outcomes. Cambridge, MA: Author. Report prepared for U.S. Department of Education.

Achilles, C. M. (1999). Let's Put Kids First Finally: Getting Class Size Right. Thousand Oaks, CA: Corwin Press.

Achilles, C. M., Egelson, P. & Finn, J. D. (1998, November). Teaching in small classes: What is the difference? Paper presented at the Mid-South Educational Research Association (MSERA). New Orleans, LA. ED431009.

Achilles, C. M., & Finn, J. D. (2000, March). Should class size be a cornerstone for educational policy? CEIC Review, Philadelphia, PA: Temple University, Center for Education in the Inner Cities. 9 (2), 15, 23.

Achilles, C. M., Finn, J. D., Gerber, S. B., Pannozzo, G. and Boyd-Zaharias, J. (2000, October 26). Small classes do reduce the test-score achievement gap. Paper presented at the Council of Great City Schools, Los Angeles, CA.

Achilles, C. M., Nye, B. A., Zaharias, J. B., & Fulton, B. D. (1995, April). Policy use of research results: Tennessee's Project Challenge. Paper at American Educational Research Association, San Francisco, CA: April 18-22, 1995.

Achilles, C. M., & Sharp, M. (1998, Fall). Solve your puzzles using class size and pupil-teacher ratio (PTR) differences. Catalyst for Change, 28 (1), 5-10.

Achilles, C. M., Kiser-Kling, K., Owen, J., & Aust, A. (1994). Success Starts Small: Life in a Small Class. Greensboro, NC: University of North Carolina at Greensboro, Final Report. Small-grant/School-based Research Project. (ERIC EA 029049)

Bain, H. P., Zaharias, J. B., Cain, V. A., Word, E., & Binkley, M. E. (1997, September). STAR Follow-up Studies, 1996-1997. Lebanon, TN: HEROS, Inc.

Bain, H., Achilles, C. M., McKenna, B., & Zaharias, J. (1992, November). Class size does make a difference. Phi Delta Kappan, 74(3), 253-256.

Borman, G. D. & D'Agostino, J. V. (1996, Winter). Title I and student achievement: A meta-analysis of federal evaluation results. Educational Evaluation and Policy Analysis, 18 (4). 309-326.

Bourke, S. (1986, Winter). How smaller is better: Some relationships between class size, teaching practices, and student achievement. American Educational Research Journal, 23 (4), 558-571.

Boyd-Zaharias, J., Achilles, C. M., Nye, B. A., & Fulton, B. D. (1995). Quality schools build on a quality start. In E. Chance (ed). Creating the Quality School. Madison, WI: Magna Publishers. 116-123.

Boyd-Zaharias, J. & Pate-Bain, H. (2000, April). The continuing impact of elementary small classes. Paper presented at AERA, New Orleans, LA.

Cahen, L. S, Filby, N., McCutcheon, G., & Kyle, D. W. (1983). Class size and instruction. New York: Longman.

Cahen, L. S, Filby, N.. N. (1979, March). The class size/achievement issue: New evidence and a research plan. Phi Delta Kappan, 492-495, 538.

Cavenaugh, R. (1994, March). Class size and best practice. Education Alternatives, 3, (1), 3. Pub. Caulfield East Victoria, 3145, Australia by David Cohen. (Olson's notes).

Chase, C. I., Mueller, D. J. & Walden, J. D. (1986, December). PRIME TIME: Its impact on instruction and achievement. Final report, Indianapolis, IN: Indiana Department of Education.

Cotton, K. & Linik, J. R. (2000, March). Part-time class size reduction at Fall City Elementary. CEIC Review, Philadelphia, PA: Temple University, Center for Education in the Inner Cities. 9 (2), 17.

Etheridge, S. (2000, May 24) Personal Communication. Etheridge is Title I Director, Berkeley County Schools, Moncks Corner, SC.

Fairfax County (VA) Schools (1997, July). Evaluation of the reduced-ratio program: Final report. Fairfax, VA: Office of Program Evaluation, Fairfax County Schools. (J. DiStefano, Principal Investigator).

Filby, N. et al. (1980). What happens in smaller classes? A Summary Report of a Field Study (ERIC ED 219 365), p. 1.

Finn, J. D., & Achilles, C. M. (1999, Summer). Tennessee's class size study: Findings, implication, misconceptions. Educational Evaluation and Policy Analysis, 21 (2), 97-107.

Finn, J. D., Gerber, S. B., Pannozzo, G. M. et al (2000, August). Evaluation of the class size reduction initiative, Buffalo Public Schools: 1999-2000. (Summary Report). Buffalo, NY: SUNY Buffalo, Baldy Hall, or Buffalo Public Schools.

Finn, J. D., Gerber, S., Farber, S. L. & Achilles, C. M. (2000, March). Teacher aides: An alternative to small classes? CEIC Review, Philadelphia, PA: Temple University, Center for Education in the Inner Cities. 9 (2), 5.

Finn, J., Gerber, S. B., Achilles, C. M., & Boyd-Zaharias, J. (2000, In Press). The enduring effects of small classes. Teachers College Record.

Finn, J. D., Gerber, S., Achilles, C. M., & Boyd-Zaharias, J. (1999, May). Short and long-term effects of small classes. Paper presented at The American Educational Research Association Annual Meeting, New Orleans, LA.

French, R. L., & Galloway, C. M., (nd). Communication events: A new look at classroom interactions. Mimeo paper. Knoxville, TN: University of Tennessee. (About 1970).

Gerber, S. Finn, J. D., Achilles, C. M. & Boyd-Zaharias, J. (2000, November). Teacher aides and students' academic achievement. Paper presented at the mid-south Educational research Association (MSERA). Bowling Green, KY. (Title at MSERA: It's time to drop the other shoe: The evidence on teacher aides.

Glass, G. V., Cahen, L. S, Smith, M. L, & Filby, N. N. (1982). School class size: Research and Policy. Beverly Hills: Sage Publications.

Glass, G. V., & Smith, M. L. (1978). Meta-analysis of research on the relationship of class size and achievement. San Francisco: Far West Laboratory for Educational Research and Development.

Hanson, M. (2000, March). Using class-size reduction resources to create a learning community: A case report of Gundry Elementary School. CEIC Review, Philadelphia, PA: Temple University, Center for Education in the Inner Cities. 9 (2), 16, 20.

Hanushek, E. A. (1999, Summer). Some findings from an independent investigation of the Tennessee STAR experiment and from other investigation of class size effects. Educational Evaluation and Policy Analysis, 21 (2), 143-163.

Hanushek, E. A. (1998, February) The Evidence on Class Size. Rochester, NY: The University of Rochester. W. Allen Wallis Institute.

Howley-Rowe, C. (2000, March). Johnson Elementary School: A case report. CEIC Review, Philadelphia, PA: Temple University, Center for Education in the Inner Cities. 9 (2), 18.

Kiser-Kling, K. (1995). A comparative study of life in first grade classrooms of 1:14 and 1:23 teacher pupil ratios (sic. Really class size. Greensboro, NC: The University of North Carolina at Greensboro. Unpublished Ed.D. Dissertation.

Krueger, A. B. (1998, January). Reassessing the view that American schools are broken.. Princeton, NJ: Princeton University, Industrial Relations section working paper 395. (1998, March). FRBNY Economic Policy Review, 29-43.

Krueger, A. B., & Whitmore, D. M. (1998). The effect of attending a small class in the early grades on college attendance plans. Background paper. Princeton, NJ.

McRobbie, J., Finn, J. D., & Harman, P. (1998, August). Class size reduction: Lessons learned from experience. Policy Brief 23. San Francisco, CA. West Ed.

Miles, K. H. & Darling-Hammond, L. (1998, Spring). Rethinking the allocation of teaching resources: Some lessons from high-performing schools. Educational Evaluation and Policy Analysis, 20 (1), 9-29.

Molnar, A (1998). Smaller classes, not vouchers, increase student achievement. Harrisburg, PA: Keystone Research Center.

Molnar, A., Smith, P., Zahorik, J., Palmer, A., Halbach, A., & Ehrle, K., (1999, Summer). Evaluating the SAGE program: A pilot program in targeted pupil-teacher reduction in Wisconsin. Educational Evaluation and Policy Analysis, 21 (2), 165-178.

Nagel, G. (2000, October 4). The class-size pendulum. Education Week. Commentary. 30-31.

Nevada Department of Education (1993, August). The 1993 class size Reduction Evaluation Study, Carson City, NV. Mary Snow, Coordinator.

Nevada Department of Education (1995, March). The Nevada Class Size Reduction Evaluation Study 1995. Carson City, NV. Mary Snow, Coordinator. The Report contains two parts. Part 1 is achievement; part 2 is opinion. Part 1 prepared by Pollard, J. P., & Yap, K. O., NW Regional Ed. Laboratory. Part 2; Costa, J. S. & Hudson, E. Clark County Schools (Feb. 1995).

Nye, B., Hedges, L. V., & Konstantopoulos, S. (1999, Summer). The long-term effects of small classes: A five-year follow-up of the Tennessee class size experiment. Educational Evaluation and Policy Analysis, 21 (2), 127-142.

Nye, B., Hedges, L. V., & Konstantopoulos, S. (2000, Spring). The effects of small classes on academic achievement: The results of the Tennessee class size experiment. American Educational Research Journal, 37 (1), 123-151.

Pleasanton (CA) Unified School District (1995, October). Class Size Reduction. A report of the ad hoc class size committee. Pleasanton, CA: Author.

Schwengel, K. (2000) Teaching ideas and processes. Personal communication. (10 years of teaching in small classes in Burke County, NC).

Shapson, S. M., Wright, E. N., Eason, G., & Fitzgerald, J., (1980, Spring). An experimental study of the effects of class size. American Educational Research Journal, 17, 141-152.

Smith, M. L. & Glass, G. V. (1979). Relationship of class-size to classroom processes, teacher satisfaction and pupil affect: A meta-analysis. San Francisco, CA Far West Laboratory for Educational Research and Development.

Stewart, T. (1998, June 29). Reduced size classes. Data Tables and Narrative. Mimeo. Updated (2000) with information provided by M. Church and T. Farris, Testing and Evaluation, Burke County Schools, Morganton, NC.

Whittington, E. H., Bain, H. P. & Achilles, C. M. (1985, Fall). Effects of class size on first-grade students. ERS SPECTRUM, 3(4), 33-39.

Wong, K. K. & Meyer, S. J. (1998, Summer). Title I schoolwide programs: A synthesis of findings from recent evaluations. Education Evaluation and Policy Analysis, 20 (2), 115-136.

Word, E., Johnston, J., Bain, H., Fulton, D. B., Boyd-Zaharias, J., , Achilles, C. M., Lintz, M. N., Folger, J. & Breda, C. (1990). Project STAR Final Technical Report. Nashville, TN: Tennessee State Department of Education.

Zahorik, J. A. (1999, September). Reducing class size leads to individualized instruction. Educational Leadership, pp. 50-53.

APPENDIX A

Issues in The Class Size and Pupil-Teacher Ratio (PTR) Confusion

In his guide on Educational Policy Systems, Iannaccone (1975) emphasized the issue at the forefront of this confusion: "Descriptive reference is the first and most essential sense in which a concept has meaning" (p. 13). This author explained that:

> . . . the clarity of the meaning of a concept turns on the precision of the relationship between the concept and its referent, the features of the world for which it is a label. One source of error in the scientific venture is lack of precision in the referent of the concepts. Lack of precision leads to lack of reliability in the concepts. (pp. 13-14).

Hanushek (1998), often cited as an "expert" on class size, made the same point as did Iannaccone. Hanushek stated that the "conceptual ideal behind any measurement" is important and made two key points: 1) ". . . pupil-teacher ratios are not the same as class sizes," and 2) "The only data that are available over time reflect the pupil-teacher ratios" (p. 12). Incredibly, Hanushek then criticizes class size by using PTR data.

Data available in large databases are generally PTR data. Surveys usually obtain PTR data. Valid and reliable ways to get class-size data are 1) to count the students in a class and/or 2) to establish class sizes and to monitor them as in Tennessee's Student Teacher Achievement Ratio (STAR) study. Consider the confusion and questionable conclusions caused in the following examples by mixing two very different concepts. (From Hanushek, 1998; C. Finn, 1997; Emphasis added in each quotation).

> The findings of the general ineffectiveness of reducing class sizes tend to be controversial if for no other reason than they tend to defy common sense, conventional wisdom, and highly publicized accounts of the available scientific evidence. (Hanushek, 1998, p. 1).

> The discussion until now has focused on pupil-teacher ratios, but pupil-teacher ratios are not the same as class sizes. These data on pupil-teacher ratios reflect the total number of teachers and the total number of students at anytime, . . . (Hanushek, p. 12).

> A policy decision to employ more teachers (such as by reducing pupil-teacher ratios, which have fallen from 27 to 1 to 17 to 1 over the past 40 years) is obviously different from a decision to hold class size constant . . . (C. Finn, 1997, pp. 48, 36).

The excerpts demonstrate problems inherent in basing class-size conclusions on PTR. Hanushek generalized about "ineffectiveness" of class size but picked and chose from PTR information. Where is his "Evidence" on class size? At best, his work offers some insights into PTR "evidence" and highlights differences between PTR and class size.

Akerhielm (1995), an economist, tried to explain the class size and PTR problems in conducting studies on class size and schooling outcomes. Her explanation, in part, is included here because it provides insights into the potential misdirection that can occur in class-size studies if there are not careful specifications of actual class sizes. (All material from p. 230).

To the extent that an aggregate ratio differs from the class size that a student was actually exposed to, measurement error exists, biasing the coefficient of the class size variable toward zero.

In addition, pupil-teacher ratios are defined as the number of students in the school divided by the number of full-time teachers for an entire school and may have nothing to do with actual class size. This ratio often includes guidance counselors, principals, and special education teachers in the count of teachers, and thus the lower the ratio, the higher the non-teaching staff, regardless of actual class size. Moreover, even if the ratio only includes actual teachers, schools with the same pupil-teacher ratio may have significantly different class sizes depending on the average number of hours of teaching required (Bowles and Levin, 1968).

The second problem is that, as opposed to using experimental (or randomized) data collected as part of a specific class size evaluation, past studies have often relied on data that were part of a larger national survey implemented for other purposes. (Emphasis added). As a result, previous research has used data in which student allocation to different class sizes may not be a random process.

If a school has a deliberate policy to assign difficult or less able students to smaller classes, then any positive effect of small class size on student performance may be disguised because such students may tend to score lower on tests.

Experimental studies in Indiana and Tennessee, in which students were randomly assigned to different class sizes and followed over time, found significant, positive effects of small classes on elementary school student achievement (McGiverin et al., 1989; Word et al., 1990). By showing the importance of small classes when there exists a random allocation of students to different class sizes, the results from experimental studies suggest that a non-random allocation may mask the true relationship between class size and student achievement.

Payne and Biddle (1999) summarized some research on school effects and included critiques of the uncritical application of research and results from one discipline to another. The rather extensive quotes are from pages 5 and 6.

. . . The Heritage Foundation, for example, has opined that:

Virtually all studies of school performance, in fact, reveal that spending has little bearing on student achievement. . . . Research demonstrates that [concentrating on performance assessment] will be far more successful than [reforms] that concentrate on salary levels and class size. (1989, p. 5).

Somehow at the time, almost nobody noticed that major errors had appeared in the "Coleman Report"—errors likely to have reduced its estimates for the size of school effects. . . . Among other things, the authors of the report had failed to use available scaling techniques to validate their procedures (p. 5).

> . . . and a number of them (economists) began to study relations between what they conceived as the "inputs" and "outputs" of public education. They have pursued several strategies for doing this, but most have involved deriving "production function models" for input-output relations within education, each stated as a complex, mathematical equation involving variables that represent aspects of students' backgrounds and school environments. These models have then been tested in empirical studies with small samples. (p. 5).
>
> Secondly, norms for publication in the field of economics stress the need for careful specification and derivation of structural models but give short shrift to the operational details of empirical studies. Thus, many studies in this literature provide few-to-no details about the sample used, the ways in which data were collected, the ways in which measuring scales were constructed, the reliability or validity of those scales, the distribution or range of values for variables in the analysis, or even the values of basic correlations among those variables.
>
> In other cases these studies have provided details, but those details have revealed serious problems. To illustrate, many studies have used samples that were too small to generate statistical significance even for substantial effects. In other cases, they have employed "convenience samples" that can only generate a distorted picture of the real world of American education. (Raymond [1968], for example, based his study on a sample of West Virginia University students who had graduated from high schools in that state. Such a sample ignores most students from poor and working-class homes. Worse, West Virginia has long had only a small range of disparities between well-funded and poorly-funded schools, so it would be "difficult—to say the least—to draw valid conclusions about the impact of school funding across America using a sample drawn from that state alone.)
>
> In summary then, because of the widespread prevalence of design flaws in this literature one *cannot* use the bulk of its studies to reach valid conclusions about the net effects of school funding in America. Previous reviewers have tried to reach such conclusions by aggregating results from the effort as a whole, but one cannot make a silk purse even out of *many* sows' ears, and unfortunately their efforts have implied, to the unwary, that one should take the corpus of this largely-flawed literature seriously.

Many (most) early discussions of class size, however, were based on available data, that is, data about PTR. Those studies formed the base for some "class-size" analyses. One concrete example from the STAR experiment may make the concept clear.

Widget Elementary School, grades K-5, has 529 students, with 261 in grades K-2 which are shown in detail (Table A-1). Kindergarten (K) has four STAR experimental classes with 86 students randomly assigned to 2 small (S), 1 regular (R), and 1 regular class with a full-time aide (RA) classes. If not in STAR, Widget would have 3 K classes for 86 students. Grades 3-5 with three classes per grade (as in grades 1 and 2) have 268 students and 9 teachers.

Ten other educators including administrator, counselor, media specialist, Title I, etc. also work at Widget. The 10 other educators and 19 regular classroom teachers give Widget a PTR of 529 divided by 29 positions, or 18.2. Only two of Widget's 19 classes—the two STAR (S) classes in K have fewer than 18.2 students. Other classes have 10-11 more students than the school's PTR of 18.2. The class-size range is 27-30 in non-STAR classes.

Table A-1 About HERE

In most STAR schools, the (R) classes that served as the control group in the experiment were smaller than the classes in the rest of the grades in the school. This occurred because one STAR guideline was that no student should have less of an education opportunity from participating in STAR than if STAR were not in that child's school. If STAR were not in Widget, the three kindergartens for 86 students would average about 29. By participating in STAR and even being in the (R) class, a student would be in a smaller class than if STAR were not at Widget. In fact, if others in the school (e.g., aides, nurse, etc.) were counted in the PTR computation, the PTR could be 529 ÷ 32, or 16.5. This example shows clearly some problems with substituting class size for the PTR. The study by Miles (1995) in Boston and other studies of class size show that class size and PTR really are, in Hanushek's (1998) own words, "not the same" (p. 12). In fact, just numerically class size and PTR are about 10 students apart, but conceptually and operationally they are worlds apart. (See Table A-2)

Table A-2 About HERE

Boozer and Rouse (1995) found important differences in class size and PTR outcomes. They addressed the PTR and class-size confusion directly. In their study, Figures 1a and 1b relate to school size. These figures showed that typically the larger the school, the more variance and thus, the larger was the difference between PTR and class size: "Figures 1a and 1b illustrate that the pupil teacher ratio and the school's average class size, while correlated, may reflect different aspects of the school's teaching resources." (p. 5). They footnoted that discussion with, "The correlation between the pupil teacher ratio and the average class size is relatively low at 0.13 in the New Jersey Survey and 0.26 in the NELS" (p. 5, Footnote 8).

Boozer and Rouse's findings help explain why PTR changes do not have much influence on student outcomes. "Once again we find that the pupil teacher ratio does not (statistically) increase in schools with a larger proportion of black students, but that the average class size does." (p. 8) and . . . "On the other hand, students in schools with larger average class sizes have significantly smaller test-score gains (p. 8). Boozer and Rouse (1995) find another important class-size difference from PTR. "Thus, using only the cross-school variation in class size we find that it satisfies two requirement for explaining the black-white gap in achievement: black students are in larger classes than are white students, and smaller classes are associated with larger test score gain." (p. 9). Left unsaid is that PTR change is most often influenced by remedial efforts and "projects" to help at-risk students, projects like Title I, the nation's largest "remedial education" effort. They concluded this discussion with "The fact the school average

class size matters, but pupil teacher (ratio) does not . . . (p. 9) and then turn to problems inherent in some production-function work, work in which Hanushek most often translates PTR analyses into class-size conclusions.

> . . . If remedial and special education classes have smaller class sizes and generate lower test score gains for a given class size than do high achieving classes, then the fitted regression line that ignores these differences will estimate an upward sloping relationship between class size and test score gains. This presents a serious problem for estimating education production functions.
>
> Theoretically, if one has within-school class sizes, then a regression including school fixed effects and allowing different slopes for the remedial and high-achieving classes should recover the hypothesized negatively sloping relationship between test-score gains and class size. However, even within these classifications, students are likely allocated to classes according to ability so that one must also account for the allocation mechanism. (p. 10. Emphasis Added).

In STAR, students were assigned to classes randomly within schools (accounting for the allocation mechanism), and then teachers were assigned randomly to classes within schools, accounting for school fixed effects. Thus, each of the 79 (76 at the conclusion) schools in STAR was essentially its own randomized, longitudinal class-size experiment, far exceeding Hanushek's 59 weak PTR "observations" (Krueger, 2000) and his 1998 and 1999 pronouncements about "class size" made by using PTR data. Hanushek never included STAR, even as one experiment, not to mention as the 76-79 it could have been using his criteria. The data were available before the 1998 and 1999 repetitions of earlier works. Amazing, both for the unabashed bias in what is claimed as research, and that educators, especially education leaders, did not admit their early dismissal of class-size evidence (e.g., Glass & Smith, 1978) and by 1990 or even 2000 begin to use the accumulating evidence from Prime Time, STAR, SAGE, etc.

References

Achilles, C. M. (1999). Let's Put Kids First Finally: Getting Class Size Right. Thousand Oaks, CA: Corwin Press.

Akerhielm, K., (1995). Does class size matter? Economics of Education Review, 14 (3), 229-241.

Boozer, M. & Rouse, C. (1995, May). Intraschool variation in class size: Patterns and implications. (ED 385935). Princeton, NJ: Princeton University, Industrial Relations Section Paper #344. National Bureau of Economic Research, Cambridge, MA.

Finn, C. E. Jr. (1997, October 29) The real teacher crisis. Education Week, 48, 36.

Finn, J. D., & Achilles, C. M. (1999, Summer). Tennessee's class size study: Findings, implication, misconceptions. Educational Evaluation and Policy Analysis, 21 (2), 97-107.

Finn, J. D., & Achilles, C. M. (1990, Fall). Answers and questions about class size: A statewide experiment. American Educational Research Journal, 27(3), 557-577.

Glass, G. V., & Smith, M. L. (1978). Meta-analysis of research on the relationship of class size and achievement. San Francisco: Far West Laboratory for Educational Research and Development.

Hanushek, E. A. (1999, Summer). Some findings from an independent investigation of the Tennessee STAR experiment and from other investigations of class size effects. (sic). Educational Evaluation and Policy Analysis, 21 (2), 143-163.

Hanushek, E. A. (1998, February) The Evidence on Class Size. Rochester, NY: The University of Rochester. W. Allen Wallis Institute.

Krueger, A. B. (2000, March). An economist's view of class size research. CEIC Review, Philadelphia, PA: Temple University, Center for Education in the Inner Cities. 9 (2), 19-20.

Miles, K. H (1995, Winter). Freeing resources for improving schools: A case study of teacher allocation in Boston public schools. Educational Evaluation and Policy Analysis (EEPA), 17 (4), 476-493.

Payne, K. J. & Biddle, B. J. (1999, August-September). Poor school funding, child poverty, and mathematics achievement. Educational Researcher, 28 (6), 4-13.

Table A-1. Example of Class-Size and Pupil-Teacher Ratio (PTR) Difference.

Grade and Classes	(n)
Kindergarten N=86 (STAR)	
Small	16
Small	16
Regular	27
Regular-Aide	27
Grade 1 N=88	
A	29
B	30
C	29
Grade 2 N=87	
A	29
B	29
C	29
Totals (K-2)	
Students	261
Teachers	10
Totals (3-5)	
Students	268
Teachers	9

Computation *

Total Students N=529

Other Educators

Title	N
Principal	1
Counselor	1
Media Specialist	1
Special Education	2
Title I	3
Art	.5
Music	.5
Physical Education	.5
Gifted	.5
Total "Other"	10
Total Regular	19
Total Educators	29

PTR = 529÷29 or 18.2

* This excludes aides (n=4), secretary (n=1) and nurse (n=.5) whose salaries could add the equivalent of 3 more professional positions, providing a PTR of 529 ÷ 32 or 16.5. Widget Elementary, a STAR School has 261 students in grades K-2, and 529 students, K-5. From Achilles, 1999, p. 33.

Table A-2. Some Major Differences Between Class Size (CS) or Class-size Reduction (CSR) and Pupil-Teacher Ratio (PTR).

VARIABLES of note in comparing PTR and CS	PUPIL-TEACHER RATIO (PTR)	CLASS SIZE (CS) or (CSR)
Definition	Students (n) at a site (building, district, class) divided by: teachers, educators, adults, (etc.) serving the site.	Students (n) in a teacher's room regularly.
Computation	DIVISION, with various divisors available depending upon the EXACT definition.	ADDITION. This cannot be accurately determined from large databases.
Concept	The teacher needs help; the student needs special services the teacher cannot provide.	A competent teacher can handle most education issues if given a reasonable case load.
Operation and Context	A project and "pull-out"-driven model full of commotion and "Band Aid" treatments. Loss of time on task. Difficulty in determining responsibility and accountability.	Teacher is responsible and accountable for the student's growth and development: Academics, Behavior, Citizenship, Development, (A, B, C, D) Small focused learning groups.
Outcomes	CONSISTENTLY MARGINAL. Note, for example, education "production function" analyses; Title I evaluations, Boozer and Rouse (1995), Borman and D'Agostino (1996) Wong and Meyer (1998), etc.	CONSISTENTLY POSITIVE on many variables (A, B, C, D). See data in Tables 1 & 2 of this paper. Much consensual validation, anecdotal evidence, and "common-sense" support.

APPENDIX B

TEACHING ACTIVITIES IN A SMALL CLASS *

This appendix contains some "stories" about teaching in a small class. The stories are from a veteran teacher with 10 years experience teaching in small classes. (2000).

COMMUNITY: It's all about trust and respect; talking and working together. I want the children to be risk takers, to interact without fear that someone will laugh or say a cruel word, or that something said will cause a failing grade. This takes time with little kids. By November, we are just beginning to understand how this works.

INDIVIDUALIZED READING: Developmentally, every child is different in the process of reading. I write an I.E.P. (much like for special-needs children) for each child. We conference and set goals which we revisit every 3 to 4 weeks. Questioning techniques allow me to add new goals and delete mastered goals. Reading individually with each child daily monitors progress.

VOLUNTEERS: There are times when I feel this part of the reading program is far more beneficial than anything else I do. My volunteers are personal friends and moms of the children who work one-on-one listening to a child read, asking comprehension questions, and helping log-in a book for the portfolio. I've seen kids sneak an extra book or an extra turn with the volunteer. They want someone to pay attention just to them.

WRITING: I have an old wooden Pepsi crate and a microphone that does not work. We write and share our pieces often by standing on the box and talking into the microphone. Little kids love to read what they have written. Teaching how to listen is part of this process. I remember the day a boy who did not write or read showed us what it is all about. He thought about what he wanted to say and drew a wonderful picture at the top of the writing paper. Then he told his story using the tape recorder. When it was his turn to share, he hopped onto the crate and held up his picture. I pushed "play." At that moment, our principal walked in to observe. She couldn't believe what she saw. Here was a child experiencing success. He knew it too. He beamed from ear to ear. (Today he is in middle school reading and writing.)

THE REFLECTIVE PRACTITIONER: Teachers need time to sit back at the end of a day and reflect on the good and the not-so-good. Children need to be met (taught) where they are. I like to think that we are "kid watchers." We should take time to observe the children working and reflect later in order to develop lessons to meet all the needs of the children. The challenge is meeting each and every one of their needs.

BOOK BUDDIES: Teachers teach by modeling. Model...model...model...Kids teach by modeling too. Older children model for younger children every day. Early in the year, first graders come to our second-grade room eager to listen to their buddies read a book, or watch a play, or sing songs from a language chart. Then one day a "younger" brings a book to share with

* By K. Schwengel, Teacher, grade 2 in Hillcrest Elementary school, Burke County, NC Schools. Thanks to the many students, parents, and educators who have helped along the way.

his buddy. Soon after, lots of buddies bring books to read. The "olders" show their buddies how to log-in their books for their portfolios. Kids helping kids. When time is up, no one moves. No one wants to break the spell.

MATH: Children learn by moving "stuff' around as they form mathematical concepts. It takes forever to get the "stuff" ready for the next day's lesson . (I just spent 1½ hours getting a tens and ones lesson together for tomorrow). I prefer to use authentic assessment. I use anecdotal records when possible. I carry a clipboard. As I notice (observe) what a child is doing I make a note on a "sticky" and stick it to the clipboard. Later, I put the "stickies" on the child's math assessment folder to use for further lessons, etc. I've also been known to don an apron with pockets. I write comments about a child on index cards and put them into my apron pocket. (I do this when there is more that needs to be written). Again, I put these cards into the child's folder. One can't possibly remember everything that was observed while children are working with manipulatives. Questioning techniques are also very helpful. In fact, they are the most helpful with a child struggling with the concept or a child who has perceptual problems, etc.

INCLUSION: We have become an inclusion school. The Resource Teacher comes into the classroom and teaches with the classroom teacher. She is not a helper. She is a teacher too. When this is possible to do, a class has two teachers teaching and observing and helping, etc. etc. It is very powerful. Some children still need services in a pull-out time. As quickly as we can get them and their teacher back into the classroom we do. Some children just need direct instruction almost one-on-one all the time, which you don't do when you do inclusion correctly.

SPECIAL NEEDS CHILDREN: On the first day of school a teacher often knows the learning abilities of her students. Good observation is necessary. I don't look at cumulative folders at first unless I sense a real problem. With small classes in grades 1-3, interventions should have begun in first grade. I continue to observe my children carefully as they work. If a learning pattern begins to show, I start a journal for that child writing down as much information throughout the day as possible. Sometimes I might tape record some things such as oral reading. When I look at this information and feel that there is a learning problem, I begin strategies such as peer tutoring, one-on-one with an adult volunteer etc. I then make a referral to the Building Assistance Team for testing. I must notify the mom twice before the referral. Early intervention is crucial. With small classes this is possible and it might save a child from later failure.

ESL: We have a large ESL population in our building. Teaching techniques are pretty much the same, but the children need one-on-one direct instruction. You have to model and model and show lots of objects and pictures for them to be successful. You have to find mentors for them because there is little or no language carry-over at home. They want to learn. In a big class they would be LOST. They have a "quiet period" when they arrive, and the teacher has to respect that. When they are ready with good solid instruction, they can learn rapidly. I have found it is very difficult to distinguish between the silent period, or the language, or a disability (They do have disabilities). I have made many referrals that turned out to be learning disabilities because I can get to know the children well. If I had 25-30, that ESL child would be left behind.

PORTFOLIO ASSESSMENT: Lots has been said about this...it takes too long....too much work for the teacher.....but, this is where it happens. This is where you see growth in a child's academic performance. The first day of school the children each write a story (benchmark). At the end of the year when I show the parents the benchmark and the last writing entry, they are amazed! Nowhere on a report card can a teacher show that growth. An A or B or E just doesn't do it. I also tape record each child reading a passage during the first week of school and again several times during the year. The differences between the first and the last tapes are something to behold. Story maps do about the same, especially if I have modeled and modeled, and then suddenly the child can do it on his own. Only a portfolio can show this.

RUBRICS: This probably goes with Authentic Assessment. I don't give A B C D or whatever. I use rubrics to score writing papers and many reading and math assignments. This takes time, but it helps me understand where the child is. Here again I use questioning techniques. Little children need to learn how to answer questions. They have a lot to offer which cannot be measured on a standardized, or true or false, or multiple choice test. I use concepts from Bloom's Taxonomy when I question. (Actually, I never knew I did this until a principal asked me where I learned to do it).

LITERATURE CIRCLES: This reading technique uses lots of wonderful strategies for learning. You teach children how to work as a unit. Lit Circles have jobs. Everyone in the group should have a job. You model each job. Once this process is done, you then teach by modeling how all the jobs fit together into a reading unit. The circle goes round and never stops. Multiple copies of books are really necessary. You can use a basal story if it is good literature. We read the story together. We partner read. Then each child does his/her job. Here is an example. We have been reading A Chair For My Mother which was a Caldecott Winner a few years back. We have been studying nouns. So we had group of word wizards. Each group of wizards had to find 5 people's names in the story, 5 animals, 5 places, and 5 things. Each group had a recorder and a spokesperson who stood up and reported on each group's findings. It was wonderful to listen to each group report. One day each child in the circle was a Passage Picker. Each chose a favorite part of the book to read to the class. They each stood on the Pepsi box and read and told us why that was their favorite part. I will tape record them reading from this book. I like to think of this as Active Learning. The kids love it. One of them said, "Do I have to go home today?" Powerful stuff.

DRAMATIZATION: We do a lot of puppet plays, drama plays, poetry. This is part of the speaking component in school. The kids love it and are not shy. It takes a long time because everyone takes part, but FUN, FUN, FUN.....

So, some of this explains a little of what I can do in a small class (13-14). Many of the ideas and activities expressed here would not be possible with 25-30 young children.

APPENDIX C. Much Research Starts From Clinical Observation (J. Prout et al.).

Observations in Small (S) (15-17 students) and Regular (R) (20-28 students) classes in the same building during the same day, revealed different patterns of teacher and student behaviors. As the day wore on, in (R) classes teachers became irritable, edgy, and showed tiredness. They wiped their eyes, sat down, and slowed or regimented instruction, often neglecting student indiscipline and off-task behavior. All occupants seemed hassled.

In (S) classes teachers taught all day. Time-on-task was constant and high. Students were well behaved, engaged, and energetic. Reciprocal student and teacher behaviors were positive. Is indoor air quality (IAQ) a major problem and factor in schooling?

The Study

Six urban schools (32 rooms) were studied. They a) contained both (R) and (S) classes, b) had the same Heating-Ventilating/Air Conditioning (HVAC) systems, and c) agreed to participate.

A scientific instrument (Q-Trac) that took four readings simultaneously (CO, CO_2, Temperature, Relative Humidity) was calibrated to check Indoor Air Quality (IAQ). Readings were taken in 32 classrooms in 6 buildings at approximately 8:00, 9:30, 11:00, 12:30, 2:00, and 3:30 (± 10 minutes). This study reports CO_2 readings over six times in a day by class size (S) vs (R). Carbon dioxide (CO_2) is related to the number of persons in a space, is cumulative, and causes drowsiness and lethargy that may influence health, teaching, and learning. Class size and time of day seemed to be key. (A2 designated room 2 in building A).

Results: Class-Size Analyses

Analyses (t-tests, correlations, regressions) used (S) classes of n=17 or fewer vs (R) classes of n=19 or more and average CO_2 readings taken at six times a day. Readings of 1200 or more parts per million (PPM) of CO_2 would get the attention of OSHA as unhealthy. The Q-Trac "maxed out" at 6000 PPM, and some (R) classrooms exceeded that reading. Class-size and time-of-day effects are evident. All rooms start approximately the same (600-700 PPM) but by day's end the (S) average (2836 PPM), although high, is 1345 PPM ($p < .007$) below the (R) average at 4181 PPM. [FIGURE 1]

The study helped explain observed classroom outcomes and behavior, [e.g., superior test scores, and greater time on task, student engagement, and teacher energy levels in (S) vs (R) classes]. Interactions of four IAQ variables are important relative to class size with implications for student achievement, behavior, and occupant health and safety. This first analysis pointed to CO_2 and cubic feet (ft^3)/student as a key issue.

Results: Cubic Feet (ft^3)/Student and CO_2 Analyses.

Although all analyses in this study portrayed problems with CO_2 in school settings, the analysis that used rooms with large ft^3/student vs rooms with small ft^3 showed the issue dramatically. This analysis used five schools with 27 separate classrooms where six measures were taken throughout the day. One school (5 classrooms) was excluded from this analysis because a) it had only grade-8 students and other schools had mostly K-4 students, b) it was a private school with 10-15 students/room, and c) two of the rooms were "outliers" with 1895 and 2842 ft^3/student while no other rooms exceeded 1305 ft^3/student (range = 284-1305 ft^3/students) with an average of 536 ft^3/student.

Results (Figure 2) show that at 8:00 AM the two groups of classrooms (large ft^3/student n=13 and small ft^3/student n = 14) had nearly equal PPM of CO_2 (648.8 v. 644.2) By 9:30 AM, the second reading, the differences between large and small ft^3/student had reached $p \leq .03$, and by the end of the school day the differences were significant at $p \leq .003$. The large ft^3/student rooms were unhealthy at 2758 CO_2 PPM, but the small ft^3/student rooms were stifling at an average of 4053 PPM of CO_2, more than 3 times what OSHA would allow for adults. Young children, with sensitive and not fully developed cardiovascular systems are in these poor IAQ rooms by compulsory-attendance laws.

Class Size Within-Schools Analyses

Using (S, n=13) and (R, n=14) classes within the same school produced the results in Figure 3. This analysis clearly shows the class-size and ft^3/student influences with (S) classes showing major IAQ advantages over (R) classes by almost 1500 PPM CO_2.

Suggestions

- Schools should be monitored for signs of poor environment, initially by observing occupant behavior.
- Specific IAQ guidelines need to be developed for schools.
- Facilities should be checked periodically for IAQ.
- School construction specifications should include cubic feet/student, not just square feet/student.
- Additional research should test connections between IAQ and student learning, occupant health, and behaviors.

Concluding Comments

Given the deteriorating condition of many U. S. schools, the increasing numbers of students and of (S) classes in elementary grades, more reports of "sick building syndrome," increasing childhood asthma, low test scores, and needs for new and remodeled schools, the policy and practice applications of these results are important. The IAQ in this sample of America's schools not only was very unhealthy, but it seemed to influence teaching and learning negatively. (This seems to border upon enforced child abuse).

NOTE: Class-size researchers continue to seek to explain why small-class students achieve and behave well. This study suggests an important intersection among school environment, class size, and school modernization needs. These results need to be replicated and expanded, but even as presented they have a key message about the effects of the schooling environment on health and behavior of teachers and students and on student achievement. The study was conducted by Jean Prout, EdD, with the help and advice of C. M. Achilles, EdD (class size), G. C. Bobbett, EdD (data analysis), and M. McEvoy EdD (environmental engineering).

Contact: C. M. Achilles
53 Snug Harbor
Geneva, NY 14456
315-789-2399
plato9936@yahoo.com

TIME	GROUP MEANS (CO_2)		
	I	II	P-value
1. 8:00	612.5	714.0	0.3025
2. 9:30	1458.4	1657.0	0.5458
3. 11:00	2203.6	2423.5	0.5647
4. 12:30	2401.0	2870.5	0.1283
5. 2:00	2540.3	3517.6	0.0198
6. 3:30	2835.7	4181.0	0.0072

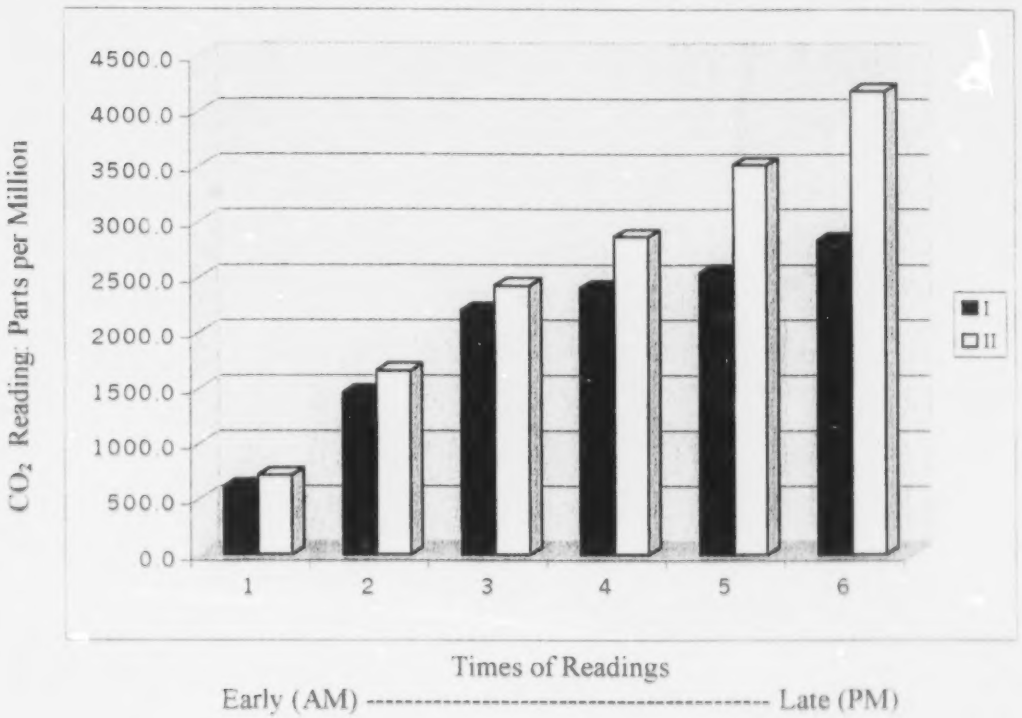

Figure 1. Analyses of CO_2 levels by class size only.

Eliminate School E. Group I is all classes with 17 or fewer students (n=11), Group II is all classes with 19 or more students (n =11). One school was excluded in this analysis for reasons cited in the text.

TIME	GROUP MEANS (CO_2)		
	Large ft^3 VII	Small ft^3 VIII	p-value
1. 8:00	648.8	644.2	.9549
2. 9:30	1183.5	1768.4	.0276
3. 11:00	1735.6	2723.6	.0018
4. 12:30	2250.2	2957.1	.0090
5. 2:00	2499.5	3595.7	.0028
6. 3:30	2757.9	4052.7	.0030

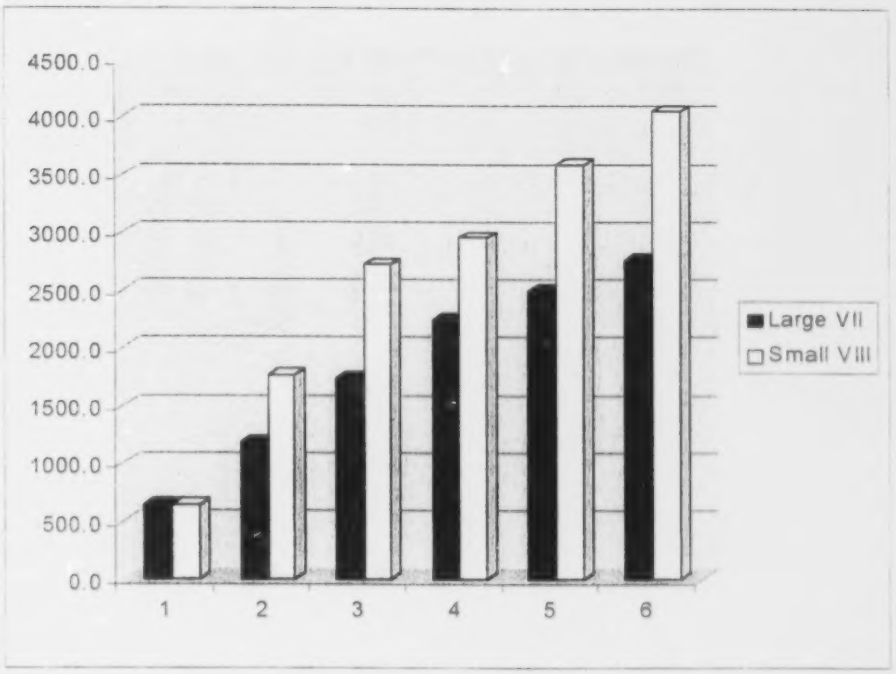

Figure 2. Analysis based on large and small cubic feet (ft^3) feet per student and CO_2 means by time of day. [1]

[1] Eliminate School E. Calculate cubic feet (ft^3)/student. Sort n=27 into large and small number of ft^3/student and compute t-tests/time.

Large (n) = 13 and small (n) = 14 amount of ft^3 /student: t-tests between large (i.e., large number of ft^3/student) and small ft^3/student and CO_2 concentration at time of day.

	TIME	GROUP MEANS (CO_2)		
		III	IV	p-value
1.	8:00	632.4	633.2	.9922
2.	9:30	1402.9	1637.9	.4437
3.	11:00	2140.6	2498.3	.3408
4.	12:30	2382.3	2940.0	.0687
5.	2:00	2622.3	3687.2	.0072
6.	3:30	2696.8	4249.3	.0003

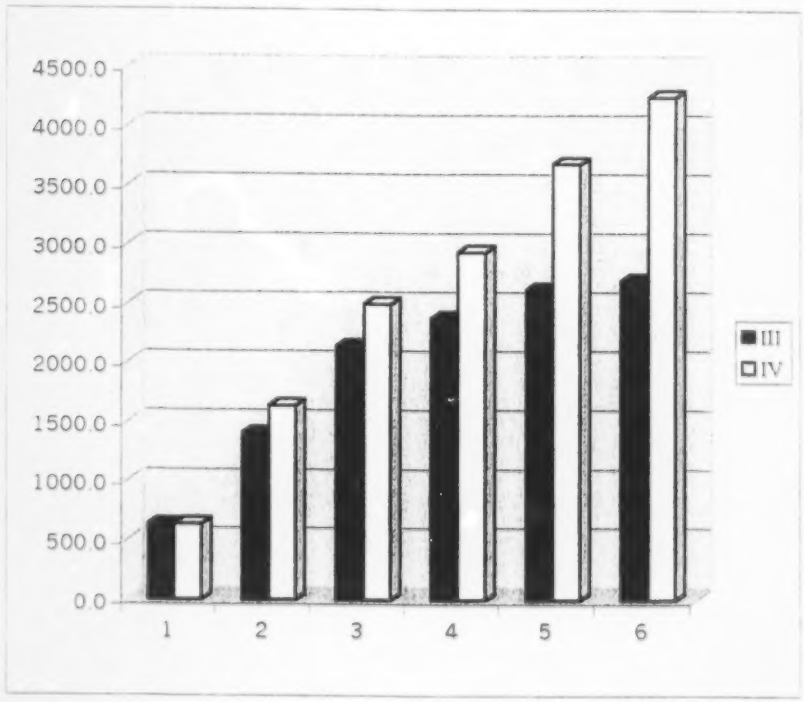

Figure 3. Small and large class comparisons by CO_2 levels using classes within schools.

Group " III " = A2, A5, B3, B4, C1, C5, C6, D3, D4, D6, F1, F2, F4 (Small, n=13)
Group " IV" = A1, A3, A4, B1, B2, C2, C3, C4, D1, D2, D5, F3, F5, F6 (Large, n=14))
School E was eliminated.